PORTFOLIO STRATEGIC CONTROL AND PORTFOLIO MANAGEMENT PERFORMANCE

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Keywords

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Abstract

BACKGROUND: Today's business challenges, fierce global competition and the growing complexity of the business environment force organisations to gain efficiency through their existing management processes and improve competitiveness by implementing new management mechanisms. Project portfolio management as one of the major competitive drivers for gaining efficiency and effectiveness requires new methods of turning it into a powerful and competitive weapon in organisation. This new approach, called "Portfolio Strategic Control", prepares portfolios for future environments by aligning portfolio objectives with organisational strategy, managing resources, risks and opportunities in an integrated fashion, and adding elements of flexibility and learning to the portfolios. Portfolio strategic control combines elements of the portfolio management process and functions of strategic control mechanism, in order to control portfolios in a strategic manner and improve the performance of portfolio management.

THE PROBLEM: The main objective of this research was to investigate the implementation of strategic control mechanism in portfolio management environments and to assess the interaction between the use of four types of strategic control (premise control, implementation control, strategic surveillance and special alert control) and portfolio management performance in different contexts.

METHOD: A sequential dual research approach was selected for this study, combining qualitative and quantitative techniques in order to obtain an optimum level of quality and credibility. The qualitative part of the study consisted of semi-structured interviews with ten individuals who hold key organisational positions in seven high-performance, market-leading organisations. The purpose of this qualitative part was to study the nature of using strategic control in portfolio environment and to obtain better understanding of the practices, tools and techniques that organisations use to apply strategic control mechanism in their portfolios. For the quantitative part of the study, a survey was administered within 48 organisations and 130 responses were collected and analysed by a series of statistical methods, in order to analyse the use of a strategic control mechanism in portfolios and to assess the relationship between strategic control and portfolio management performance in

different contexts. While quantitative data were used to provide accurate empirical results without bias, the qualitative part added richness to those findings.

RESULTS: The research results indicated that organisational tendency to use a strategic control mechanism in portfolios increases when organisations experience a high level of portfolio complexity and high level of portfolio dynamic. Also, the results revealed that there is a positive and significant relationship between the use of a strategic control mechanism in portfolio and portfolio management performance. This direct relationship is moderated by contextual factors of portfolio size, portfolio interdependency, portfolio dynamic and organisational governance type.

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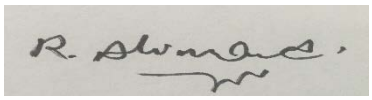
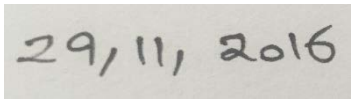
Statement of Original Authorship

The work contained in this thesis has not been previously submitted to meet requirements for an award at this or any other higher education institution. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made.

Signature:  QUT Verified Signature

Date:  November 2016

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I wish to dedicate this thesis to my life partner, Roja, for her endless love, unfailing support and encouragement.

Chapter 1: Introduction

This chapter outlines the background of this research (Section 1.1) and the research problems (section 1.2). Section 1.3 describes the purpose of the study and section 1.4 describes the significance and the scope of the study, followed by section1.5, which provides definition of terms. Finally, section 1.5 includes an outline of the remaining chapters of the thesis.

1.1 Background

Strategy refers to a series of actions and plans developed in order to achieve a specific target (Ghemawat 2002, p. 37). Chandler (1962, p. 13) describes strategy in an organisation as a means of determining long term targets and objectives, designing action plans and allocating required resources to carry out a course of actions. Hofer and Schendel (1978, p. 25) define strategy as the "fundamental pattern of present and planned resources deployment and environmental interactions that indicates how the organisation will achieve its objectives." Strategies are made in accordance to an organisation's environmental variables including external opportunities and threats as well as internal strengths and weaknesses (Fiegener 1990, p. 10). In addition, strategies should be controlled over the period of their definition and implementation, to ensure defined targets and objectives are being achieved (Muralidharan 1997, p. 65). The term of control refers to a series of actions which strive to capture information regarding performed tasks, and compare the results with predetermined standards to assure those tasks will proceed to defined plans (Newman 1984, p. 34).

The role of the control process has undergone significant changes over the last decades, from a traditional perspective to one that is very strategic in nature. Firms are forced by environment and external factors to control their business processes in a more strategic way, to be able to remain competitive in the market. This strategic approach becomes vital when firms are dealing with long term planning where decisions are made to respond to future unknown factors that are beyond the control of the firms. In order to apply this long-term, strategic approach, firms need to develop a chain of activities to connect the organisation's missions and grand

strategies to short term plans. In addition, development, and implementation of measures to assess the effectiveness of the chain of actions are the essential part of this strategic approach. Evaluation of results in the medium and short term is a key factor to change the direction of long range plans (Pearce and Robinson 2011, p. 13). Therefore, control of strategic plans should not be limited to the feedback control process and needs to be expanded in a wider and more strategic way that controls plans, based on environmental changes, and assesses the direction of strategy to ensure strategic objectives will be met (Schreyögg and Steinmann 1987, p. 92).

The demands for applying strategic approaches to the business process have led to a significant evolution in the field of management over the last decades. For achieving strategic plans in a changing world, firms use projects as one of the effective instruments in an organisation (Turner 2014, p. 83). However, the deployment of projects or a portfolio of projects to implement a long-term strategy is a new domain in management literature (Kerzner 2013, p. 34). There have been many calls for research to define the link between strategy and project to implement the strategy in the organisation however, this area has not been studied thoroughly (Young and Young 2012, p. 59). Implementation of a strategic plan as a long-term approach in project environment as a temporary effort has a paradox in nature. This paradox leads to a gap in the project management and strategic management literature. This research is intended to identify and define the abovementioned gap and provide a model to facilitate implementation of strategic control in a portfolio of projects.

1.2 Research Problem

The failure of strategy implementation and associated problems are connected to the failure of control process (Roush and Ball 1980, p. 5). Traditional approaches to control, regardless of what is being controlled, involves three basic stages: (1) establishing a series of standards, (2) performing works and activities, measuring actual performance against defined standards to provide feedback, and (3) taking the necessary actions to correct deviations from standards and plans (Koontz, O'Donnell et al. 1980, p. 722). While this traditional approach may be useful for some short-term activities, it has many drawbacks in the control of long-term strategies. In the post-action control system, we wait until completion of the

strategy execution phase and then we are able to find out the result of how well the strategy was working. As it could take years to implement the strategy to measure the performance against the plan and to identify deviations, the opportunity to correct deviations in order to redefine the strategy would have been lost (Preble 1992 p. 392). In rapid changing environmental conditions, this problematic side of feedback control causes an adverse effect on strategy implementation. Another drawback of traditional control is connected to the predetermined standards, which are considered to be correct, and any deviation from these standards are required corrective actions; however, it is possible that the standards and measures have been changed during the strategy implementation, and they are no longer valid (Schreyögg and Steinmann 1987, p. 92). Overall, what is needed to answer the limitations of the traditional control process is an additional control loop, which examines both results and metrics during the strategy implementation (Argyris 1976, p. 369) and learns from past actions to improve future results. This double loop control system is called a strategic control mechanism (Preble 1992, p. 393).

To achieve a strategic plan in the changing world, organisations use projects or a portfolio of projects more than they do operations (Turner 2014, p. 23). “A project is a temporary endeavour undertaken to create a unique product, service, or result. The temporary nature of projects indicates a definite beginning and end” (Project Management 2013, p. 3). In 1999 Shenhar proposed a new direction towards projects and defined a project as the temporary organisations and processes that have been set to achieve certain goals under the constraints of time, budget, and other resources (Shenhar 1999, p. 382). If a portfolio of projects is considered as a temporary or even permanent organisation (Turner and Müller 2003, p. 7), it needs the same level of control as its parent organisation over its life cycle, to achieve stated goals and targets.

In order to be strategically adaptive, a portfolio of projects must develop some processes that prepare it to respond to a potential future environment, and enable it to enjoy a better fit with its current environment. A portfolio of projects needs the newer approach, which contains elements of flexibility and learning that are called “portfolio strategic control.” This research will answer the question whether this proposed new approach to control a portfolio of projects provides better results in managing the portfolio and achieving the portfolio goals and

objectives. This broad term leads to the primary research question, which asks: *How is a portfolio of projects strategically controlled and how is this control mechanism related to the performance of a portfolio management system?*

1.3 Purposes

Portfolios of projects is designed as one of the main organisational tools to deliver a set of strategic objectives under constraints of time, budget, scope, quality, and other resources. Therefore, organisations need to control portfolios in different levels to ensure those strategic objectives are being addressed while operational constraints are met. It means, portfolios should be concurrently controlled operationally at project levels and strategically at organisation level. Past studies reviewed the role of strategic control within organisations and also the impact of operational control on project success. The limited research on the utilisation of strategic control mechanisms in portfolio environment are clear signs of literature review process. In addition, tracking of portfolio management literature reveals that there are calls for investigating on how an organisation controls its portfolio of projects and how this control mechanism affects portfolio management performance (Müller, Martinsuo et al. 2008, p. 30). Therefore, the main motivation behind this study is the need for further understanding of portfolio control and its effectiveness for portfolio success. This study is concerned with one of the essential processes of a diversified business organisation: strategic control of portfolio management. In particular, the objectives of this studies are as follows:

- To review, the deployment of strategic control mechanisms in the portfolio management process.
- To investigates the interaction of project portfolio performance and strategic management processes.

Abovementioned objectives are developed based on two major premises (1) strategic control functions are important in achieving organisational objectives and business successes, and (2) project portfolio management provides organisations with an absolute advantage that can be effectively used to execute organisational strategies.

To achieve the research objectives, it is important to understand characteristic of strategic control within organisations, by analysing data from the literature review and by investigating organisations in order to find how firm's mission, vision, process management assets, and enterprise environmental factors are contributed to use of strategic control at portfolio level. Since the broad research question as mentioned in section 1.2, investigates how a portfolio of project is controlled, it is important to clarify the context and understand organisations where the control mechanism is taking place. Therefore, a solid research method is required in order to investigate the use of strategic control mechanism within organisations at portfolio level.

At the first stage, it is required to analyse the organisations' vision, mission and management process asset including process descriptions, control procedures, strategic management, and portfolio management documents as well as learn the personal views and ideas of key people who are involved in strategy formulation, implementation and evaluation, and people who are responsible for portfolio execution in organisations. Gathering information through that approach assists in understanding the real situation within organisations regarding use of strategic control mechanisms in the portfolio environment and developing appropriate hypotheses for the research. The main hypothesis and primary model of the study will be emerged from literature review and analysing of interviews. In the second stage, the main hypothesis is broken down into a set of hypotheses based on literature and results of the first stage and are tested through a quantitative method. To conduct this part of the study, the theoretical model underlying the research design should be clearly defined and hypotheses should be completely understood to define a comprehensive survey questionnaires. The results of the data gathering in the second stage should be analysed by series of statistical methods to examine each of the research hypothesis. Upon completion of hypotheses testing the practical outcome of the research will be emerged, which is a contingency model defining the use of the strategic control mechanism in a project portfolio and its relationship with portfolio management performance.

1.4 Significance and Scope

The project-based management process is a new management system in order to driver organisational objectives; thirty percent of the global economy is project-based (Turner 2014, p. 58). Several studies showed the effectiveness of a project's success on organisational performance (Menke 1997, p. 41);(Buys and Stander 2012, p. 13). However, as the research literature proves, most projects fail to meet their objectives. (Shenhar, Dvir et al. 2001, p. 701). These objectives include business goals, schedule and budget targets and also quality objectives. Another study showed that almost thirty percent of projects failed to meet expected success criteria (Buys and Stander 2012, p. 66). Therefore, a portfolio of projects thats components are failing to meet their objectives, is not able to contribute to organisational success and accordingly does not strategically fit in a parent organisation.

Organisations undertake numerous traditional ways to improve the process they use to achieve better results. These include project management tools and techniques, improved reporting and communication techniques, PMOs and maturity models, providing training to personnel etc. However, there is a limit to how much it is possible to improve the process by just focusing on these items (Shenhar 2007, p. 121). Therefore, organisations will have to move more towards a new form of strategic management to achieve project and portfolio objectives. Traditional approaches to control, focus on cost, schedule, quality and scope baselines (Rodrigues and Bowers 1996, p. 122). These traditional methods do not review the portfolio and its components over their lifecycle to assess whether they are on track to meet the strategic objective for which they were selected. Therefore, organisations will have to use the new control method instead of traditional ones to obtain a better performance of their portfolios. This research will focus on the deployment of this new approach and its effects on project portfolio performance.

The significance of this study can be viewed from two distinct perspectives:

- From the theoretical point of view: Although in recent years there are more calls for focusing on portfolio management performance (Martinsuo and Lehtonen 2007, p. 59), and also there are studies on the impact of portfolio control in portfolio management performance (Müller, Martinsuo et al. 2008, p. 30), there is no empirical evidence of investigating the

relationship between the use of a strategic control mechanism in the portfolio management process and its impact on portfolio management performance. Moreover, there is no confirmed standard framework to connect the strategic control techniques and project portfolio management elements. This research will be the first step in developing such a framework.

- From the practical point of view: Today's business challenges, fierce global competition and the growing complexity of the business environment force organisations to gain efficiency through their management process and improve competitiveness; project portfolio management is one of the main drivers for gaining efficiency and effectiveness. However, aligning portfolio objectives with organisational strategy and measuring the performance of a portfolio in achieving those strategic objectives, need a dynamic and strategic control system.

This study focuses on how organisations strategically control their portfolio of projects to achieve a better performance; it reviews the following areas:

- Strategic control system and its role in the organisational management process;
- Portfolio management process including portfolio control mechanism, portfolio selection and optimisation methods and their links to organisational strategy;
- The interaction among strategic control process, portfolio management performance and portfolio contextual factors;
- The effectiveness of organisational governance type on relationship between use of strategic control system in portfolio and portfolio management performance;

The justification of this study can be concluded as follows:

- It has both theoretical and practical significances as mentioned above;
- It is researchable because there are enough examples of related literature on strategic control and portfolio management. In addition, proposed hypotheses can be measured and tested through a series of qualitative and quantitative methods;

- It is feasible since it can be completed in a given timeframe and there is a confirmed target population for the study;

1.5 Definitions

Simple known terminologies are used to avoid ambiguity and connect with most business, management and industry terminologies as follows:

Portfolio: according to The Standard for Portfolio Management (PMI 2014, p. 2) portfolio "is a component collection of projects, programs, or operations managed as group to achieve objectives." In this research, 'portfolio' refers to a portfolio of projects.

Project Portfolio Management (PPM): "project portfolio management is coordinated management methods and interrelated organisational processes in order to achieve organisation value, goals and vision" (PMI 2014, p. 5).

Portfolio Management Performance: the degree that a portfolio contributes to the organisational strategy and objectives (PMI 2014, p. 85). The operational definition of portfolio management performance will be presented in section 3.5. In this study the term of portfolio performance is used for portfolio management performance.

Strategy: strategy, is a high level plan and set of actions designed to achieve a series of predetermined goals and targets under conditions of uncertainty (Ghemawat 2002, p. 37).

Traditional Control Systems: a traditional control system is a feed-back loop comparing actual performance with predetermined measures and standards in order to measure the achievement of targets and objectives (Schreyögg and Steinmann 1987, p. 91). In this research, a traditional control system refers to operational control mechanisms, which are used to measure cost, time and quality performances.

Strategic Control Systems: strategic control systems is a feed-forward oriented approach which uses a system of formal and informal procedures in order to control the direction, effectiveness and integration of strategy (Solieri 2000, p. 54).

1.6 Thesis Outline

The thesis is divided into the following chapters:

Chapter 1: Introduction: This includes a brief explanation of the research background, research problems, the purpose, significance and scope of the research, and definition of terms used.

Chapter 2: Literature review: The review provides a critical analysis of the theoretical and empirical literature about the strategic control concept in general management and business management. It also reviews project portfolio management, project portfolio performance and approaches to the portfolio control mechanism. In addition, the contingency theories are discussed at portfolio, organisation, and environmental levels. This includes the gaps found in areas of strategic control and portfolio management and it covers related comments made in previous literature. At the end of the review, research questions and research hypotheses are articulated and a high level research model is presented.

Chapter 3: Research Design: This describes the research methodology and research design, including data source and collection methods, analysis approach and instruments used. The research variables are presented in this section and all research variables were operationalised, based on the literature and interviews. At the end of the chapter, research limitations, research strengths and weakness are presented.

Chapter 4: Results: The results of statistical analysis of the research questions and their associated hypotheses are presented in this section in a way to clearly show that hypotheses are supported. The results of survey demographics and descriptive statistics of variables are presented.

Chapter 5: Discussion: Here, the research findings are discussed by relating the results to research objectives and literature. It also provides evidence of how this research is supported by previous literature as well as the results of the qualitative part of the study.

Chapter 6: Conclusion: This chapter provides a summary and the conclusion of the research outcomes. It discusses the implication of the research findings and the recommendation is made based on the results of the study.

Chapter 2: Literature Review

This chapter begins with some historical background (section 2.1 2.1) and reviews literature on the following topics:

Section 2.2: the concept of strategic control is reviewed and it is compared with a traditional control approach, followed by a review of theoretical and managerial frameworks of the modern strategic control concept. Then, strategic control theories are categorised by their characteristics in order to be used as variables in the research analysis.

Section 2.3: project portfolio management and how it is connected to organisational strategies and objectives are reviewed in this section. Project portfolio selection, prioritisation and optimisation processes are discussed. Portfolio management performance criteria are presented and the links between portfolio control and portfolio performance are highlighted.

Section 2.4: contingent variables related to organisational strategy and project portfolio management are reviewed and contextual factors at environmental level, organisational level and portfolio level are presented.

Section 2.5: highlights the implications from the literature and summarises the findings.

Section 2.6: presents the research question, research hypotheses and conceptual model of the study.

2.1 Historical Background

The use of project and portfolio of projects for implementation of organisational strategy has been developed in the project management literature from the early 1970s and in the strategic management literature from the 1980s. The project portfolio concept is presented in recent literature as the most powerful contributor to the emerging field of strategy implementation (Young and Young 2012, p. 58). How projects and a portfolio of projects are connected to a broader strategy of organisation, has received increased attention over recent years (Müller, Martinsuo et al. 2008, p. 28). Although the project portfolio is an effective tool in

achieving an organisation's goals and targets, it is challenged by internal and external environmental changes and various uncertainties, which have the potential to impact defined objectives and strategies (Korhonen, Laine et al. 2014, p. 21). Therefore, academic researchers and industrial managers have focused on developing solutions to monitor, control and manage those changes and uncertainties, and mitigate their impact on the course of strategy (Petit and Hobbs 2010, p. 46).

2.2 Strategic Management: Control and Evaluation

The field of strategic management is one of the distinct sub-disciplines of management studies (Preble 1992, p. 391) that has been receiving more attention in recent years (Young and Young 2012, p. 59). Strategy leads organisations to achieve desired goals and objectives (Keddy and Aswathappa 2009, p. 301). Normative models of the strategic management process divide strategy into three steps: strategy formulation, strategy implementation and strategy evaluation and control (David 2011, p. 114). Strategy formulation consists of developing high level mission, vision and desired goals for the firm, analysing internal and external environment to understand the firm's strengths and weaknesses as well as opportunities and threats, and then determining a firm's future based on the analysis results (Preble 1992, p. 391). In the strategy formulation process, a list of alternative strategies is developed for execution in different levels of organisation (Keddy and Aswathappa 2009, p. 13). Strategy implementation includes execution of different strategies that were developed during strategy formulation by effective communication and interpretation of strategies in different level of organisation, as well as improving and enhancing the strategies by implementation of required changes to the organisation structures and processes (Cholip 2008, p. 20). Strategy implementation is executed by middle managers in the organisation, while the effectiveness of the execution processes are evaluated by high level managers to ensure the target objectives are being achieved. The evaluation process of strategy implementation focuses on measuring the actual results with the predetermined standards and undertaking the required corrective actions to solve the problems and to provide information for future actions (Preble 1992, p. 392).

Figure 1, adapted from Hunger and Wheelen model (Hunger, Hoffman et al. 2015, p. 160), depicts the strategic management process.

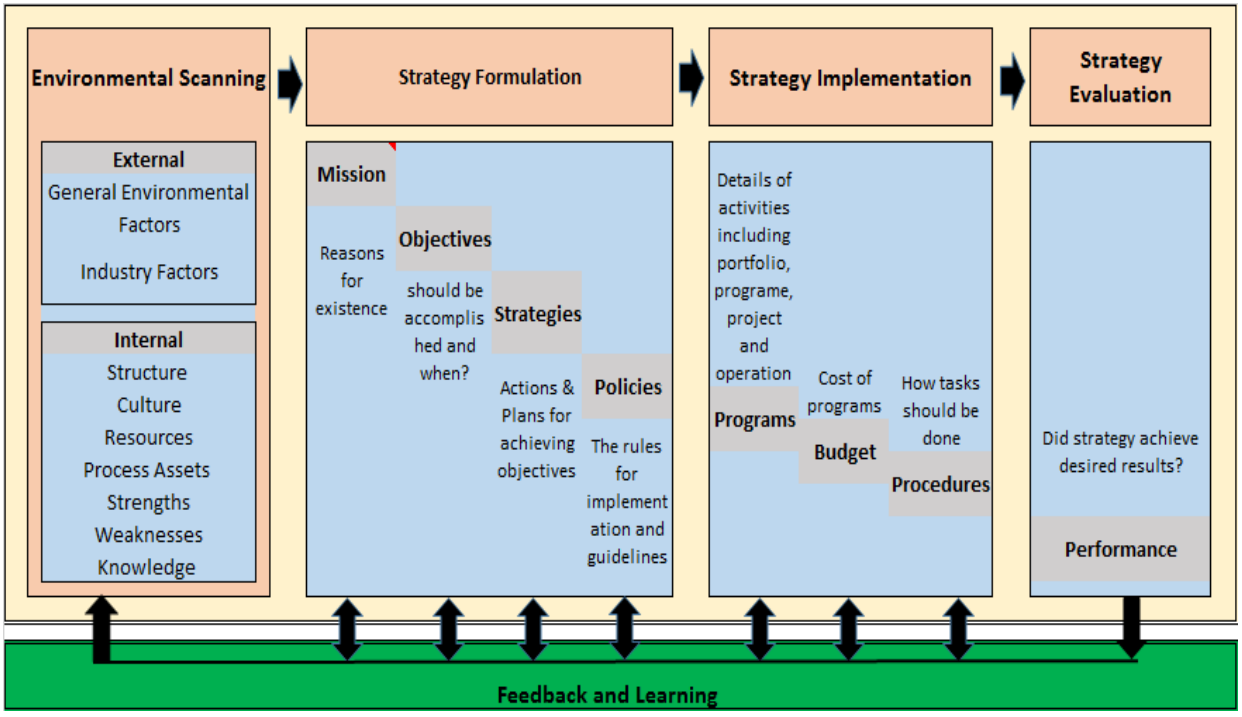


Figure 1: Strategic Control Model

Adapted from "Concept of Management" presented to the Society for Advancement of Management. International Meeting. Richmond. VA. 1981. TL. (Hunger, Hoffman et al. 2015)

2.2.1 Strategic Control

Strategic control is a means of evaluating organisation plans and activities, and defining future actions to keep the organisation on track for its strategic movement (Preble 1992, p. 393). It helps the organisation to identify impending treats and potential opportunities in advance, in order to develop fit-for-purpose responses in a timely manner. Also, it assists organisation developing a systematic approach for trade-off between competing values (Band and Scanlan 1995, p. 110).

In order to meet its strategic objectives, organisations need to (1) establish strategic direction to maintain the dynamic alignment of strategies, (2) develop strategic effectiveness to ensure that the strategy implementation process is effective and efficient, and (3) make sure that strategy is implemented in an integrated manner in all levels of organisation. Strategic control is the formal and informal processes in order to assist an organisation in developing and maintaining its strategic direction, strategic effectiveness and strategic integration (Solieri 2000, p. 21).

Based on the literature, the scope and concept of strategic control can be categorised into two main approaches: (1) traditional approach and (2) modern approach.

The traditional strategic control process is a linear feedback system (Band and Scanlan 1995, p. 105) that focuses more on strategy implementation and essentially performs the four following steps:

1- Develop measurable standards, quality process and metrics;

2- Measure actual performance to defined metrics;

3- Evaluate the performance information and perform variance analysis; and

4- Undertake corrective actions.

Preble described the traditional strategic control process as depicted in Figure 2.

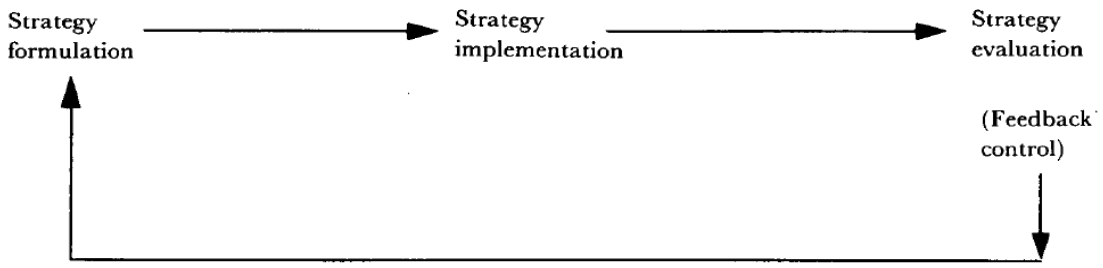


Figure 2: Traditional Strategic Control Management

It is obvious that, in this approach, corrective actions will take place in the future, where uncertainties, complexities and environmental situations including opportunities and threats do not play an important role. In addition, in this approach it is assumed that the defined standards and metrics are valid and will remain valid during the implementation phase. This approach reviews the strategy to make sure it is being implemented as planned and the results are those intended (Schendel 1979, p. 125).

There are two main drawbacks to this approach:

1- This is a “post-action” control system (Schreyögg and Steinmann 1987, p. 92), which means the corrective actions can be executed once the strategy implementation and deviation analysis are completed. Therefore, the corrective actions may come too late to solve the problems and correct the deviations.

2- This is a “single loop” system that is developed and implemented based on the assumption that the defined standards and metrics are valid and any deviations from those standards are negative and “bad”. However, it is possible that during the implementation phase and due to the changing environments, some metrics are becoming obsolete. In addition, logic for this mechanism does not allow the assumption that the deviation is “good” because the plans were “bad” (Schreyögg and Steinmann 1987, p. 92).

It is obvious that during implementation of this feed-back control system, organisations may lose time, resources and opportunities, and may make themselves more vulnerable to environmental threats (Lorange, Scott Morton et al. 1986, p. 189).

This classical approach is a common process in project management and portfolio management practices in order to measure performance of projects and success of portfolios. Therefore, all the mentioned drawbacks are applicable to project of portfolio by considering the portfolio as a temporary or permanent organisation.

2.2.2 Theoretical Frameworks in Modern Strategic Control Literature

Despite the traditional approach developed by Schendel and Hofer (1979), a modern strategic control system emphasises uncertainty, external and internal environment and associated changes. In addition, it focuses on the future rather than the past. A significant milestone in the expansion of strategic control was reached when Schreyogg and Steinmann in 1987 introduced a new concept of strategic controls that included a feed-forward process (Solieri 2000, p. 22). They proposed their model based on the limitation of the feedback model of strategic control and developed an alternative to the classical model.

2.2.2.1 Schreyögg and Steinmann Model (1987)

The most important frameworks in modern strategic control belong to Schreyogg and Steinmann. They proposed a three stage, feed-forward model (see

figure 3), which takes into account the features of strategic management such as environmental uncertainty, hostility, and complexity, as well as bounded rationality of planning (Band and Scanlan 1995, p. 106).

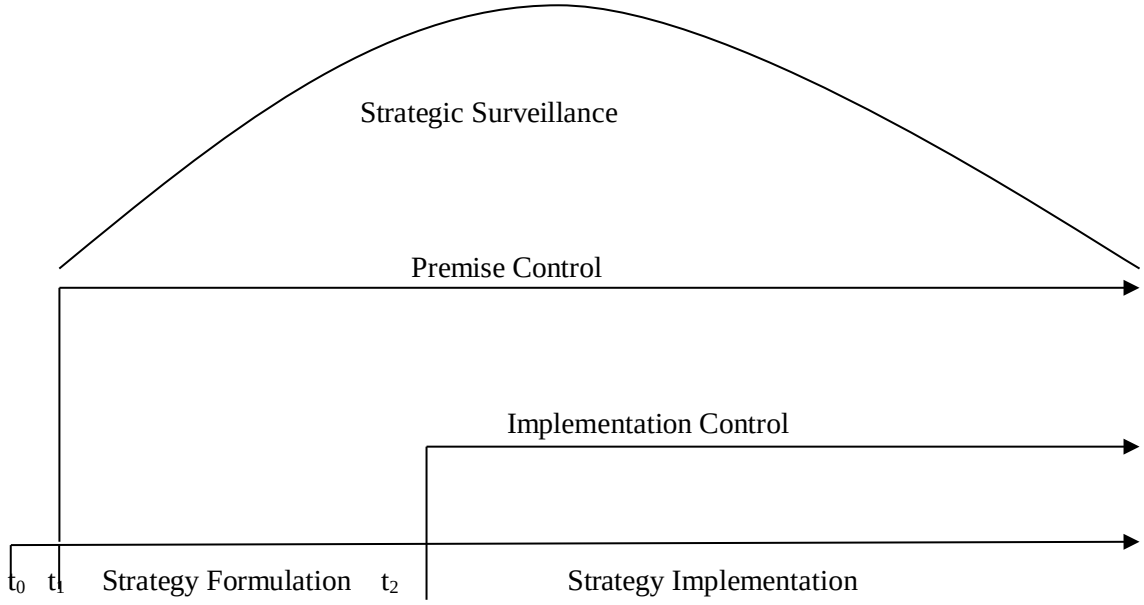


Figure 3: Strategic Control Model (Schreyögg and Steinmann 1987)

Premises Control

Every strategy is based on certain planning premises and assumptions and those assumptions are subject to change (Jauch and Glueck 1988, p. 453). Premise control is designed to methodically and continuously check the internal and external environmental conditions, in order to find whether the premises that were defined during the strategy formulation and strategy implementation phases are still valid and reliable (Fiegener 1990, p. 66). Premise controls represent a significant missing element in the traditional control and assist organisation to identify invalid promises and to take corrective actions at the right time. Key premises that have significant impact on the organisation if they change, need more attention and control effort. Therefore, an organisation must check the premises and variables that (1) are based on weak forecasts (2) are sensitive to environmental changes, and (3) are based on data that are out of the control of the organisation (Schreyögg and Steinmann 1987, p. 96).

Premises are primarily based on environmental and industry factors which are underlying the existing strategies (Pearce and Robinson 2011, p. 355). Although an organisation does not have control over the external business environmental factors, those factors have significant impact on the performance of strategies, as strategies are based on those premises (Keddy and Aswathappa 2009, p. 304). This assumption monitoring system, forewarns organisations about any environmental conditions that have the potential to be out of control (Fiegener 1990, p. 92) and gives organisations a strong signal regarding the proper time for objective reconceptualisation (Lorange, Scott Morton et al. 1986).

Implementation Control

Strategy implementation consists of development and execution of a series of plans, programs and portfolios over a period of time (Pearce and Robinson 2011, p. 358). According to the model presented by Schreyögg and Steinmann, implantation control starts once the strategy implementation has commenced and it will take place over an extended period of implementation, in order to assess the basic direction of strategy in the light of past events (Schreyögg and Steinmann 1987, p. 97). Those past events are early signals from performance results that show that the current strategy may not align with overall organisational strategy anymore (Fiegener 1990, p. 79). During the strategy implementation, new information becomes available as the result of plans, portfolios, program and projects execution. Organisations need to review and analyse that information in order to assess the broad strategic course for potential change or modification (Solieri 2000, p. 23). In addition, strategic implementation control is supposed to identify factors and events which were not considered during strategy formulation and have the potential to change the basic direction of the current strategy (Band and Scanlan 1995, p. 106). While operational controls systematically evaluate performance against predetermined metrics and standards over a short period of time, strategic implementation controls the overall strategy direction in light of results provided during the strategy implementation phase (Pearce and Robinson 2011, p. 358). Implementation control does not replace operational control and both are needed to control strategy efficiently and effectively (Schreyögg and Steinmann 1987, p. 97).

Unlike the other strategic management scholars such as Ansof & Bosman (1982, p. 27) and Lorange & Scott Morton (1986, p. 254), who limit the

implementation control to new strategies, Schreyögg and Steinmann believe that strategic implementation control should be applied to current strategy as well as new strategic projects. For new strategic projects, implementation control assists in the decision making process regarding termination or continuation of the project and using "stop/go" assessment in different milestones in order to optimise the current strategy (Schreyögg and Steinmann 1987, p. 97). This approach to strategic control implementation becomes more important when organisations intend to control their portfolio strategically and apply an implementation control mechanism in order to optimise their portfolio, by terminating the existing projects and/or adding new projects to the portfolio.

The two basic types of implementation control are: (1) monitoring strategic thrusts or projects and (2) milestone reviews (Pearce and Robinson 2011, p. 358).

Monitoring strategic Thrust or Projects: as part of the implementation of a broad strategy, managers need to undertake short term and narrow projects, in order to identify if the overall strategy is being implemented as a plan. Those strategic projects are reviewed and are assessed by operational control systems such as time, cost and quality controls in a certain phase of strategy implementation, to enable managers to decide about the overall strategy directions (Pearce and Robinson 2011, p. 360). These projects are short-term goals, which are used as indicators for long-term decisions regarding the overall direction of strategy (Fiegener 1990, p. 81)

Milestone Reviews: during strategy planning, a series of major events or milestones are defined in order to assess the strategy implementation performances against defined metrics at a given time, to determine whether the whole strategy should be terminated or altered. The assessment of strategy implementation should be a full scale and comprehensive assessment to provide required information regarding the overall strategy directions. Managers need to select meaningful and critical points for undertaking milestone reviews in order to ensure that a thorough and comprehensive assessment of current strategy leads to a clear decision on the strategy's future. Those points may occur when a major step is reached or when a critical decision regarding further and future investment should be made (Pearce and Robinson 2011, p. 361).

Strategic Surveillance

Strategic surveillance is supposed to complement the other two control stages by monitoring a broad range of internal and external events, which are likely to affect the course of strategic action (Band and Scanlan 1995, p. 106). Despite the two other strategic control processes, strategic surveillance is an unfocused control and must be kept open and should be executed in an unstructured manner to enable an organisation to uncover important yet unanticipated information from multiple information sources (Pearce and Robinson 2011, p. 357). Strategic surveillance is designed as a safeguard to protect a whole range of established strategy in a constant way. While one of the main objectives of a planning system is monitoring the environment for opportunities, the basic task of a control system is observing threats for the current strategy (Schreyögg and Steinmann 1987, p. 98). Figure 4 summarised the characteristic of three strategic control types.

Type of Strategic Control / Charachteristics	Strategic Surveillance	Premise Control	Implementation Control
Degree of Focusing	Low	High	High
Object of Control	Potential Threats of Strategy	Planning Premises	Milestones

Figure 4: Type and Characteristic of Strategic Control

Schreyögg and Steinmann (1987), proposed a universal and fully integrated process for controlling strategy formulation and strategy implementation. This universalistic approach states that there is only one way, under all circumstances, in which to implement a control system. This universal approach can be considered as a drawback to their proposed model as a strategic control model needs to act in a flexible manner and be able to be modify its process based on environmental conditions (Goold and Quinn 1990).

2.2.2.2 Goold and Quinn; the Paradox of Strategic Control (1992)

Goold and Quinn referred to the paradox of strategic control in theory and practice. They believed, despite the extensive research that has been conducted in the field of strategic control and advanced development of theories in this area, that there are few companies that have implemented a formal strategic control system and have

developed required tools, techniques, standards and metrics to strategically control their organisation and their long-term plans (Goold and Quinn 1990, p. 43).

However, over the past 25 years, despite the fact that companies around the world have implemented strategic control systems more effectively and have developed formal and informal metrics to measure their strategic position among their competitors, there is still an extensive gap between strategic control theories and practical levels in organisations. At least it can be said that strategic control processes and techniques have not been commonly used at the level of portfolio and project in organisations.

Goold and Quinn proposed three main reasons for the development of a strategic control system: (1) need for a comprehensive agreement between different levels of organisation regarding plans, objectives and targets, (2) need for an intensive reward and sanction system to keep the managers who are responsible for implementation of strategies motivated in order to ensure they peruse the agreed objectives, (3) need for a decision-making system to enable high level managers to intervene in a timely fashion in order to provide alternative plans, execute the reward and sanction system or even change the whole direction of a plan (Goold and Quinn 1990, p. 43).

Since the formal and inflexible strategic control system has the potential to become ineffective, Goold and Quinn suggested that organisations need to keep their strategic control system more flexible to enable the organisation to respond to environmental changes in a timely manner and in a more appropriate way. These authors believed implementation of the Schreyögg and Steinmann (1987) model would require a huge amount of effort and resources (Preble 1992, p. 397). They proposed their model be based on the environmental turbulence and ability of an organisation to develop appropriate strategic metrics, and measuring the performance based on the defined standards (see Figure 5). The model shows that strategic control can be problematic when organisations experiencing a high level of dynamic and strategic objectives are not clearly defined.

strategic control system valuable, but should not be tightly administer	strategic control problematic	high
strategic control system valuable	strategic control more for tracking progress and motivation	low
Easy	difficult	

Environmental Turbulence

Ability to specify and measure precise Strategic objective

Figure 5: Strategic Control Model (Goold and Quinn 1990)

2.2.2.3 Preble Strategic Control Model (1992)

Organisations make strategic planning assumptions primarily based on the environmental and industry factors; therefore it is necessary to monitor those factors continuously in order to improve the strategic planning. Organisations need to develop a systematic method to continuously check the environmental information to find if any of the environmental premises have changed and accordingly it is required to alter the strategy.(Preble 1992, p. 398). As it is mentioned by Goold and Quinn (1990), continuous monitoring of all assumptions would require massive effort and resources. In order to respond to this limit, Preble (1992) proposed a complementary model by adding a new controlling technique to scan the environmental assumptions and information. He named this new method "Special Alert Control" and it is responsible for identifying high level threats with low probability (see Figure 6).

Preble considered special alert control as a crisis management tool, which is designed to identify vulnerable areas, develop alternative plans, and practise reactions to the crisis (Preble 1992, p. 404). This strategic control approach focuses on environmental factors, industry factors and strategy-specific factors (Pearce and Robinson 2011, p. 356).

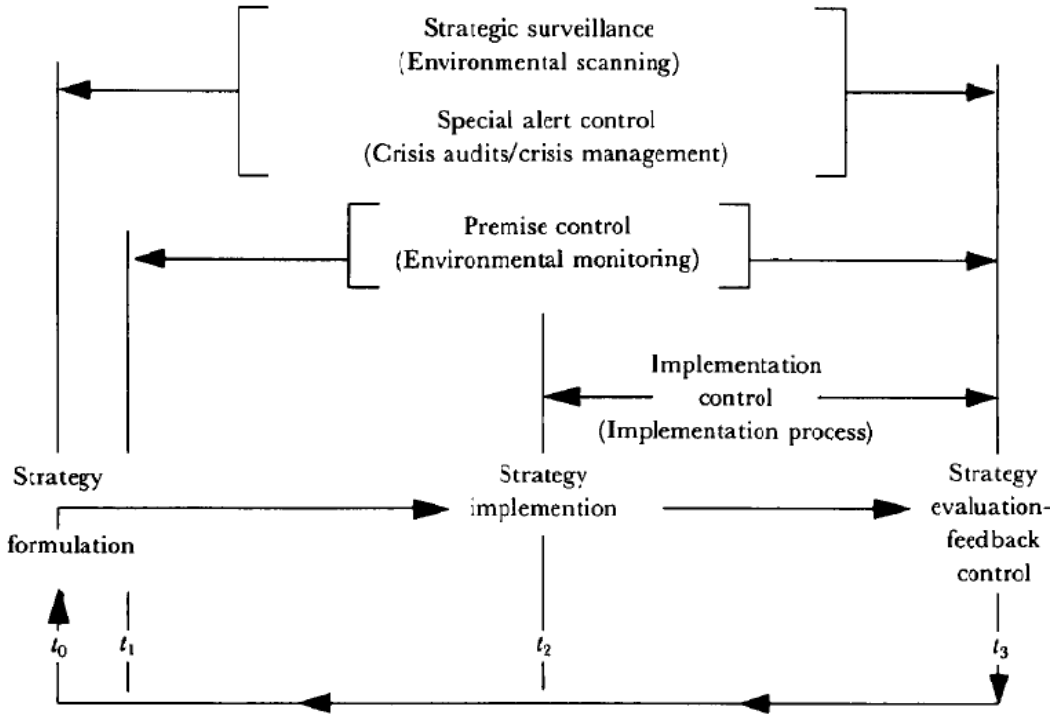


Figure 6: Strategic Control Components in the Strategic Management Process

(Preble 1992, p. 395)

Preble distinguished special alert control from strategic surveillance by its function and time.

- Function: strategic surveillance should keep premises current and strategies valid, while special alert control keeps organisations ready for a time of crisis, as they need to be more cautious about high level risks, which have the potential to threaten their strategies (Band and Scanlan 1995, p. 106).
- Time of application: special alert control only can be applied during the implementation phase (from t_1 to t_3), while strategic surveillance continuously monitors environmental information from strategy formulation to strategy evaluation (from t_0 to t_3)(Keddy and Aswathappa 2009, p. 306).

2.2.2.4 Strategic Control for Fast Moving Market (Muralidharan 1997)

Muralidharan distinguished strategic control from traditional management control by two characteristics of focus and purpose. (Muralidharan 1997, p. 64). He presented various approaches to strategic control based on these two characteristics, which are summarised as follows:

The Control of Strategy Implementation: the main purpose of this strategic control is to ensure that strategies are implemented as formulated (Muralidharan 1997, p. 65). The control of strategy implementation processes focuses on key strategic success factors to make sure that the objectives of strategy are being met, while traditional management control ensures that all elements of the plan are being implemented in accordance with defined standards and metrics (Bungay and Goold 1991, p. 33).

Validating of Strategic Assumptions: in this strategic control approach, assumptions of strategy are validated continuously to ensure the strategy itself is in the right direction. In order to constantly validate the assumptions of strategy, organisations need to simplify assumptions and act selectively (Schreyögg and Steinmann 1987, p. 98). The managerial processes of this approach focus on the content of strategy itself and are completely different from traditional management control. The processes are undertaken by different levels of the organisation

including line managers and high level managers, while the decision about whether the strategy should be terminated or altered remains with high level executives (Muralidharan 1997, p. 65).

Managing Strategic Issues: Organisations develop strategies periodically based on basic assumptions and continuously validate the assumptions, however, a constantly changing environment alters those assumptions during the implementation and brings about new risks and opportunities to the organisation. (Muralidharan 1997, p. 66). Strategic issues are forthcoming events or trends that are developed by the internal or external environment of an organisation and have the potential to affect the organisation's strategy (Ansoff 1980, p. 133). Managing of strategic issues or Strategic Issue Management (SIM) is a series of plans, processes and procedures to identify the impact of internal and external strategic issues and respond to them at the right time. It includes (1) continuous surveillance of internal and external issues that may impact the strategic key success factors and update those strategic issue lists periodically, and (2) develop and implement a series of management actions to solve the strategic issues and manage their risks and opportunities. (Ansoff 1980, p. 134). This managerial action is different in terms of focus, process and tools from the traditional management control. This series of management actions include:

- Development of required tools and technique for early identification of strategic issues,
- Evaluation of the criticality of strategic issues in order to prioritise strategic actions,
- Development of response plans and projects to implement.

Periodic Review of Strategy: This approach consists of a periodic, comprehensive review of strategy as a means of interval gates to identify and analyse the cumulative impact of low and high profile changes and develop required managerial actions (Muralidharan 1997, p. 66). Because it is a wide-scale review and need extensive time and resources, the frequency of this review should be once in one year or more years (Goold and Quinn 1990, p. 47). Although many of the low profile changes in the organisational environment may not be noticeable and may be treated as unimportant changes, the cumulative impact of them may have the potential to affect the whole strategy over a period of time. Therefore, it is important

to collect data from the internal and external environments continuously, and review and analyse those data periodically (Newman 1984, p. 121).

2.2.2.5 Strategic Control for in Triggering Strategic Changes (Julian and Scifres 2002)

Strategic control has an important role in the development of a systematic process to identify and interpret "change triggers" in the constantly changing environment. The authors emphasised the interpretation of strategic data and environment changes during each process of the Schreyogg and Steinmann model (1987) including all processes and contents of premise control, strategic surveillance and implementation control. Their model (Figure 7) has three major processes including: scanning/monitoring; analysis/interpretation; and response (Julian and Scifres 2002, p. 142).

Data interpretation in each process plays an essential role in the development of appropriate, quality and timely responses by an organisation. Moreover, the structure of monitoring processes and standard managerial actions used by organisations in scanning internal and external environments have critical impact on data interpretation in each phase and accordingly, in the response development process (Julian and Scifres 2002, p. 146).

Gathering data during implementation control needs to be undertaken in a formal and structured manner by development of milestone review, processes, procedures and schedules, while acquisition of data by strategic surveillance and premise control needs to be performed in a less formalised fashion (Schreyögg and Steinmann 1987, p. 100).

In order to provide quality and accurate information by premise control and strategic surveillance, organisations need to perform the data acquisition process in a decentralised manner, while data acquisition by implementation control needs to be performed by high level managers and mid-level managers who are involved with implementation of strategy (Julian and Scifres 2002, p. 150 & 151).

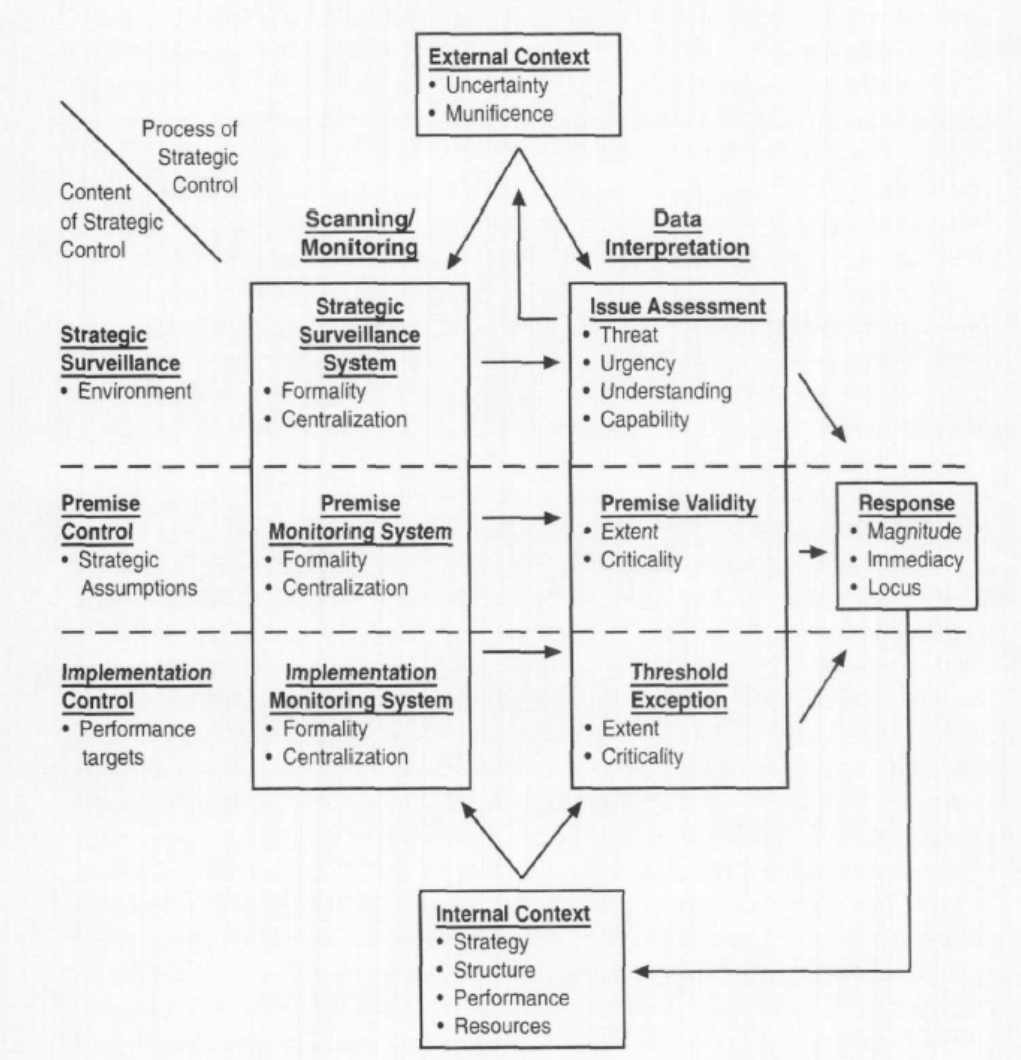


Figure 7: Strategic Control Process (Julian and Scifres 2002, p. 144)

2.2.2.6 Summary of Strategic Control Theories and Frameworks

The concept and definition of strategic control systems used by various authors, with the assistance of Muralidharan's strategic management categories, are summarised in Table 1, in order to select the strategic control variables for this study. The characteristics of four types of strategic control with the assistance of (Schreyögg and Steinmann 1987, p. 98 & 100) and (Pearce and Robinson 2011, p. 356) is represented in Table 2.

Strategic Control Approach	Authors
Control of Strategy Implementation (Implementation Control)	(Lorange, Scott Morton et al. 1986) (Schreyögg and Steinmann 1987) (Preble 1992) (Julian and Scifres 2002) (Pearce and Robinson 2011)
Validating Strategic Assumptions (Premise Control)	(Schreyögg and Steinmann 1987) (Preble 1992) (Julian and Scifres 2002) (Pearce and Robinson 2011)
Managing Strategic Issues (Strategic Surveillance Control)	(Lorange, Scott Morton et al. 1986) (Schreyögg and Steinmann 1987) (Preble 1992) (Julian and Scifres 2002) (Pearce and Robinson 2011)
Special Alert Control	(Preble 1992) (Pearce and Robinson 2011)

Table 1: Different Strategic Control Theories and Frameworks

Basic Characteristics	Types of Strategic Control			
	Premise Control	**Implementation Control**	**Strategic Surveillance**	**Special Alert Control**
Objects of control	Planning premises and assumptions	Key strategic thrust and milestones	Potential threats and opportunities related to the strategy	High impact events with low probability
Degree of focusing	High	High	Low	High
Data acquisition:				
Formalization	Medium	High	Low	High
Centralization	Low	Medium	Low	High
Data handling:				
Formalization	Medium	Medium	Medium	High
Centralization	High	High	High	High
Use with:				
Environmental Factors	Yes	Seldom	Yes	Yes
industry Factors	Yes	Seldom	Yes	Yes
Strategy-specific factors	No	Yes	Seldom	Yes
Company-specific factors	No	Yes	Seldom	Seldom

Table 2: Characteristic of Strategic Controls

2.2.3 Role of Balanced Scorecard Methodologies and Critical Success Factors in Strategic Control

Balanced Scorecard Method

The method of the Balanced Scorecard, is an approach to link operational and strategic control by designing a performance measurement system based on financial and non-financial indicators in order to balance financial objectives in the implementation and control of strategies. (Wijn and Van Veen-Dirks 2002, p. 408). By conducting the balanced scorecard method, organisations are able to measure comprehensively and continuously their performance and decide about the future of their strategies based on the feedback from the balanced scorecard (Pearce and Robinson 2011, p. 365).

Organisations use the balanced scorecard in order to:

1. Define, clarify and update strategy, and build consensus around the organisation regarding strategy;
2. Cascade information regarding the strategy's targets and objectives from top managers to business units and individuals to align management processes;

3. Set interim targets, establishing milestones to link objectives of strategy to organisation long-term financial performance as well as annual budgets;
4. Undertake performance reviews in order to improve strategy and provide strategic feedback (Kaplan and Norton 1996, p. 85).

Kaplan and Norton suggested translation of strategy into four perspectives and to acquire and analyse data and develop performance indicators in each of these perspectives:

1. *Financial Perspective:* organisations measure financial performance by indicators such as cash flow, income growth, return on equity, and risk index (Pearce and Robinson 2011, p. 365). In this perspective typical goals are profitability, growth and shareholder value (Kaplan and Norton 1992, p. 77).
2. *Internal Business Process Perspective:* internal process perspective focuses on internal plans and processes, which enable organisations to provide value expected by customers and financial outcomes (Kaplan and Norton 1992, p. 75). Internal processes include: operation management, customer management, regulatory and stakeholder management.
3. *Customer Perspective:* customer perspective processes focus on customer satisfaction and providing customer value. Organisations should develop metrics in order to measure time and quality of service performances (Kaplan and Norton 1992, p. 73)
4. *The Learning and Growth Perspective:* this process focuses on continuous improvement and creating value in the organisation; the associated scorecards measure an organisation's performance related to innovations, growth (Pearce and Robinson 2011, p. 364) and operation efficiencies (Kaplan and Norton 1992, p. 76). Organisations need to improve their core competencies and skills, as well as provide to employees the required training in order to improve employees' contributions and their morale (Kaplan and Norton 1996, p. 83).

Kaplan and Norton (2000, p. 68) suggested that organisations need to develop a strategy map based on the four perspectives to (1) define strategy clearly for organisations at all different levels of organisation, reach consensus and then develop expected targets (2) develop meaningful relationship between critical outcomes and strategy drivers, (3) develop effective links between the organisation's strategic

management processes and the organisation's processes at each business unit, (4) measure performance for the organisation's business units from a top-down perspective and provide strategic feedback, (5) identify problem areas and point out areas for improvement.

Critical Success Factors Method

John Rockart, who introduced critical success factors (CSFs) in 1979, defined CSFs as "a limited number of areas in which results, if they are satisfactory, will ensure successful competitive performance for organisation" (Rockart 1979, p. 85). CSFs is another non-financial method used in order to measure an organisation's performance comprehensively (Wijn and Van Veen-Dirks 2002, p. 408). CSFs is a top-down methodology for formulating strategy in an organisation and it can be applied during the control phase to measure strategy performance (Sanchez and Robert 2010, p. 65).

Rockart (1979) distinguished five critical sources of organisational success:

1. *Industry:* the nature, characteristic and structure of each industry determines success factors in the industry; those factors should be selected by managers, based on needs and structure of the organisation.
2. *Competitive Strategy and Industry Position:* organisation's current position in any given industry, its defined strategic plans, and its capabilities and resources are important areas which affect the critical success factors.
3. *Environmental Factors:* environmental factors are those factors that are out of control of the organisation, but have potential impacts on the organisation and its strategies.
4. *Temporal Factors:* temporal factors are created based on the short-term situation or crises and become critical over a short period of time.
5. *Managerial Positions:* based on the manager's functional position and his/her perspectives, a series of critical success factors are generated.

In the critical success factors' method of strategic control, the CSFs are generated from the market and based on those factors, metrics and benchmarks are

developed in order to measure the associated value of the strategy (Wijn and Van Veen-Dirks 2002, p. 413).

2.3 Project Portfolio Management

A portfolio is defined by the Project Management Institute (PMI) as "a collection of programs, projects, or operations managed as a group to achieve strategic objectives" (PMI 2014, p. 2). A portfolio is defined by Turner and Müller (2003, p. 7) as a temporary or permanent organisation where components of the portfolio, including projects and programmes, share and compete for the pool of resources that are managed by the sponsor of the portfolio (Archer and Ghasemzadeh 1999, p. 208). Platje et al. (1994, p. 100) defined portfolio as a set of projects that are managed and coordinated together in order to deliver stated objectives that would not be possible if the projects were managed independently. The mission of a portfolio is to achieve organisational strategic plans and objectives, therefore the portfolio should be linked to the organisation's strategy, should be viewed from a corporate prospective and all components of the portfolio should represent the investments made by organisation (PMI 2014, p. 3).

Project portfolio management is a dynamic, flexible and iterative decision mechanism (Müller, Martinsuo et al. 2008, p. 28) which enables organisations to select, prioritise and monitor portfolio components and their alignment with an organisation's objectives (PMI 2014, p. 4). This management process also assists organisations to optimise portfolio capacities in order to respond to environmental constraints and reduce uncertainties (Bible, Bivins et al. 2011, p. 3). Project portfolio management is a link between organisational strategy and operational project management (Turner 2014, p. 121), therefore management of projects in a portfolio should be carried out at an aggregate level, which enables a portfolio to monitor, control and measure the performance of each project regarding its alignment with overall organisational objectives, and prioritise or re-align projects within a portfolio (Rad, Levin et al. 2006, p. 13). In the portfolio management process, it is important to realise predetermined objectives, understand an organisation's capacities, and monitor organisational changes in order to invest in the right projects and execute those projects in an efficient and effective manner (Enterprise Portfolio Management and Wiley 2009, p. 5).

The objectives developed by the portfolio management process are the lowest-level output of the strategic planning process in an organisation, which are supposed to support the organisation's vision, mission and strategic objectives (Bible, Bivins et al. 2011, p. 3). The objectives of a portfolio can be defined as: (1) maximising the value of portfolio, (2) linking portfolio management with the organisation's strategic planning, implantation and control processes, (3) creating a balanced portfolio for efficient allocation of resources and managing risks and opportunities within that portfolio (Cooper, Edgett et al. 2002) and (4) responding to environmental changes and their impacts on the portfolio and its organisation in an efficient fashion (Office of Government 2007, p. 58).

2.3.1 Strategic Portfolio Management

High performance portfolio management, which can significantly contribute to organisational strategic plans and retain its alignment with overall organisational objectives, needs a dynamic and robust framework to ensure achievement of the stated objectives (Rad, Levin et al. 2006, p. 66). Also, it needs an agile and systematic approach to monitor and respond to ongoing changes in order to develop the appropriate course of actions (PMI 2014, p. 40). Successful organisations develop effective frameworks, tools and techniques for defining, aligning and controlling portfolio as well as selecting and prioritising projects within a portfolio, which better supports the organisation's strategy (Müller, Martinsuo et al. 2008, p. 38).

2.3.1.1 Portfolio Definition and Organisational Strategy

Organisational strategy must arise from an organisation's mission, which explains why an organisation exists in the market (Hofer and Schendel 1978, p. 8). It determines the basic long-term goals of the organisation and defines a pattern of formal and informal plans, actions and resource allocations in order to achieve those goals and objectives (Chandler 1962, p. 13). Strategies are formulated based on the organisation's environmental variables, opportunities and threats as well as in accordance with organisation strengths and weaknesses (Fiegener 1990, p. 10). Organisational strategy is intended to minimise the impact of environmental threats and maximise opportunities by responding to environmental changes at the right time and with allocation of optimum resources in order to increase organisational performance and value. (Caiazza and Volpe 2014, p. 15).

It is important that the relationship between an organisation's strategies and its business units is clearly understood by the organisation at different levels, in order to visualise the objectives for each business unit and align short-term objectives with long-term goals. This relationship, which links the organisation's strategic plan with organisation processes at each business unit is called strategic alignment (Andolsen 2007, p. 35). A tight alignment ensures executives that each business unit has a valuable contribution to overall organisation objectives and goals (Brocke and Rosemann 2009, p. 1). An effective strategic alignment should (1) provide insight to the organisation's goals in order to explain how those goals are relevant to organisation mission, (2) communicate its goals throughout organisation and link them to long-term and short-term objectives and (3) provide suitable ground for decision making, resource allocation and controlling processes (Bible, Bivins et al. 2011, p. 20).

One of the major drivers for an organisation's strategy for achieving strategic objectives is project portfolio management, which is the integral part of the organisation's strategic plans (PMI 2014, p. 6). Portfolio management is a key process in aligning projects with organisational strategy (Turner 2014, p. 412). The term of strategic alignment can be applied to portfolio as a business unit within organisations to establish a meaningful relationship between portfolio components and organisational strategy. The portfolio strategic alignment should focus on the prioritisation process of portfolio components, effective allocation of resources by eliminating redundancies, managing threats and opportunities as a whole to reduce uncertainties and increasing the overall performance of the portfolio (Levin and Wyzalek 2014, p. 150). This alignment provides the portfolio with effective tools to valuably contribute to the organisation's overall mission, goals and objectives.

Dietrich and Lehtonen (2005, p. 389) found that most successful organisations include their portfolio management as part of the strategy process for the organisation and review their portfolio in conjunction with a strategy follow-up process. Bible and Bivins (2012, p. 1) stated that effective portfolio alignment can increase the chance of achieving defined organisational objectives and goals by:

1. Selecting the components that support defined objectives and are aligned with an organisation's strategic goals and missions (Bible and Bivins 2012, p. 1). Organisations should possess effective tools and techniques to

support decision making process for portfolio selection in order to meet stated objectives while dealing with organisation resource constraints (Ghasemzadeh and Archer 2000, p. 73). It is important that the organisation's priorities, tangible and intangible benefits, and organisation's risk profile and risk threshold, are thoroughly reviewed during this decision-making process in order to meet defined targets (Schniederjans and Santhanam 1993, p. 248). Although there are various tools and techniques that organisations can use to undertake the selection process (Schniederjans and Santhanam 1993, p. 185), evaluation and decision-making techniques should follow the organisation's strategic formulation and implementation processes.

2. Monitor portfolio performance to measure the effectiveness and efficiency of portfolio components (Bible and Bivins 2012, p. 1). Organisations should define strategic performance indicators to measure the performance of each portfolio component and its alignment with overall organisation's objectives (Sanchez and Robert 2010, p. 64). The control approach and associated metrics should be developed based on the organisation's strategic control processes, which cover key strategic performance indicators.
3. Continuously monitor internal and external changes in order to find areas in which strategy and portfolio need adjustments (Bible and Bivins 2012, p. 1). During implementation of the project portfolio, assumptions and premises, based on which the portfolio is defined, should be constantly monitored in order to ensure those assumptions are still valid. In addition, the portfolio management team should continuously monitor the broad range of internal and external events that are likely to affect the course of portfolio implementation and take into account those changes that have impact on portfolio performance. Undertaking monitoring and the evaluation process may result in termination of some projects within the portfolio as well as the selection of new projects which are more aligned with the organisation's strategic objectives.

Portfolio alignment analysis should be continuously undertaken by a portfolio management team to ensure the portfolio retains its effectiveness and efficiency in

contributing to achieve the stated organisational objectives. This alignment analysis focuses on (1) the portfolio objectives and goals and their relation to new or changing organisational strategy and objectives (PMI 2014, p. 44) (2) portfolio components and their alignment within the portfolio to find conflict and redundancy (Levin and Wyzalek 2014, p. 151).

Portfolio strategy should be developed in accordance with organisational strategy in order to enable the portfolio to understand and support those strategies, using principles and fundamentals for its development (Vara 2014, p. 152). For effective and successful portfolio management, it is essential that higher managers have a holistic view of portfolios and clearly understand the purpose of any given project of portfolios, and its performance and degree of alignment with strategic objectives (Morris, Pinto et al. 2007, p. 23). From the other side, it is important that the portfolio management team have a clear understanding of organisational strategic objectives, goals and targets and being aware of potential changes that may affect their projects or programmes. To meet the two abovementioned criteria, it is essential to (1) link project portfolio processes effectively to the organisation's strategic planning processes (2) understand how the organisation's strategic management perceives portfolio management functions and vice versa (3) accept that projects of a portfolio are the best tools to deal with environmental changes facing the organisation (Morris, Pinto et al. 2007, p. 64).

Bible and Bivins, et al. (2011) presented a five-phase iterative sequential model (Figure 8) that shows portfolio management process from strategic planning through portfolio evaluation and adjustment. In the first stage, organisations develop and prioritise objectives based on strategic goals, mission and vision, followed by identifying, evaluating and selecting portfolio components. During the implementation phase, continuous monitoring and control of portfolio components is required to measure performance and strategic alignment of the portfolio in order to prioritise components and make the required adjustments based on the measurement results.

This model integrates portfolio management with the organisation's strategic objectives. In addition, it indicates that selection, monitoring, evaluation and control processes should move hand-in-hand with the organisation's strategic formulation, implementation and control management activities. It is important that organisations

use appropriate and effective tools and techniques for the implementation of each phase

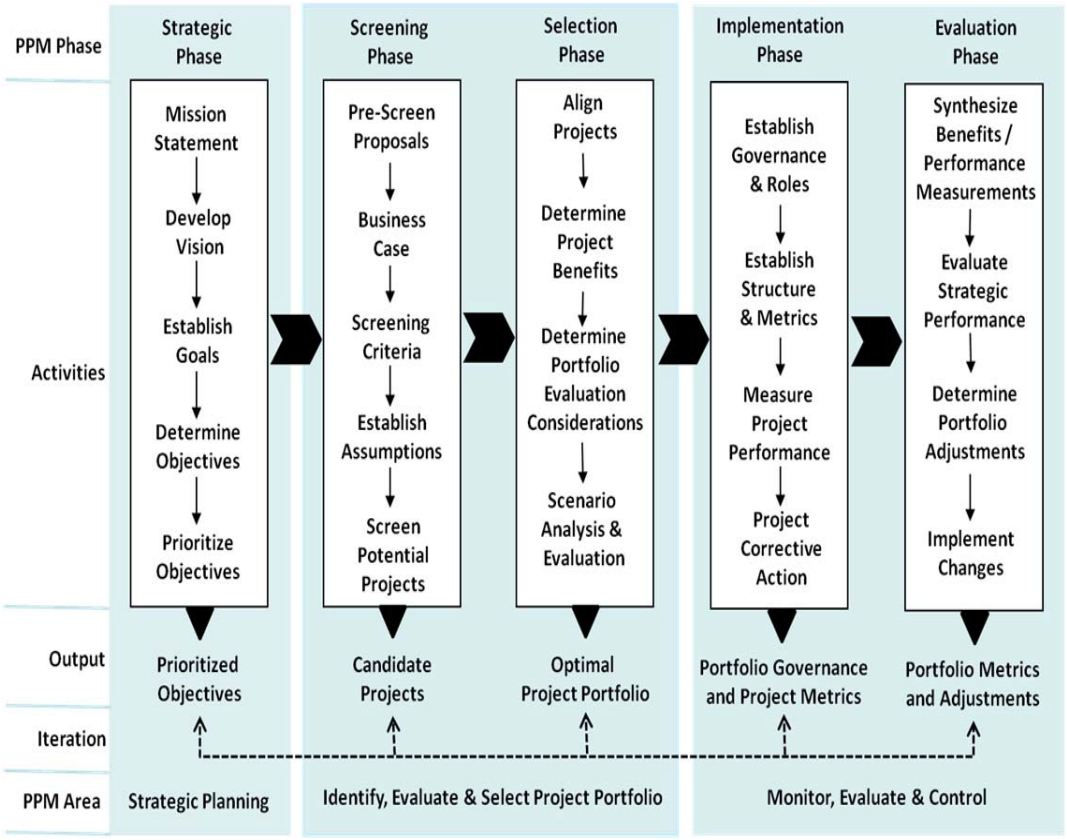


Figure 8: Project Portfolio Process Overview (Bible, Bivins et al. 2011, p. 20)

It is suggested that the same principle of strategy mapping, including strategy planning, implementation and control, should apply to portfolio planning process as a business unit of an organisation.

Developing portfolio management processes in accordance with organisational strategy and linking these two processes together assists in:

1. Providing a balanced and executable plan to maintain alignment of portfolio with an organisation's objectives and gaols (PMI 2014, p. 8);
2. Defining portfolio management objectives, plans and processes that support organisational strategy;
3. Providing a holistic view of ongoing portfolio activities, their components and emerging ideas from different levels of organisation (Morris, Pinto et al. 2007).

4. Early identification of issues and risks that arise from portfolio components and have the potential to affect strategic objectives;
5. Effective communication and clear interpretation of strategic objectives throughout the organisation by providing a portfolio team the chance to actively participate in the strategic planning process (Bible, Bivins et al. 2011, p. 31).
6. Effective and efficient allocation of resources through portfolios and organisation (PMI 2014, p. 8) by assisting higher managers to acquire a better understanding of the organisation's capabilities and capacities (Bible, Bivins et al. 2011, p. 5).

2.3.1.2 Portfolio Control

Project portfolio control refers to the process that organisations use to control a portfolio in order to achieve portfolio success (Müller, Martinsuo et al. 2008, p. 29). Organisations normally use some forms of control over a portfolio and its components, such as gate-phase review, milestone review, balanced scorecard and review of critical success factors (PMI 2014, p. 21). Portfolio control consists of review and evolution of portfolio components, including projects and programme, monitoring strategic changes and reviewing performance indicators for the evolution of portfolio alignment (PMI 2014, p. 31). Müller et al. (2008, p. 29) categorised portfolio control literature into three areas: (1) portfolio selection, as a form of behavioural control which aims at selecting, prioritising and optimising portfolio in alignment with organisational strategy (2) portfolio reporting as a form of output control, which is the process of reporting projects within portfolio, and (3) portfolio decision making as a form of interactive control, which is concerned with how decisions are made regarding the portfolio management process (Müller, Martinsuo et al. 2008, p. 35). For this research, portfolio control, prioritisation and optimisation have been adapted from their study.

Portfolio Selection

Portfolio management literature emphasises the linkage of portfolio selection in line with organisational strategy and success of the portfolio (Meskendahl 2010, p. 807). Project selection is a periodic organisational strategic activity, which is linked to the business strategy of an organisation (Archer and Ghasemzadeh 2004, p. 237).

The aim of this process is to assess, evaluate and choose projects and/or a group of projects that better support an organisation's objectives from a pool of initiatives (Costantino, Di Gravio et al. 2015, p. 1745). Müller et al. considered portfolio selection as a form of behavioural control process and proposed that selecting projects in line with organisational strategy is positively related to portfolio performance (Müller, Martinsuo et al. 2008, p. 36).

Ghasemzadeh (1998) mentioned seven difficulties that should be addressed during portfolio selection: (1) prioritisation of multiple and conflicting objectives, (2) comparing qualitative and quantitative objectives and integrating tangible and intangible criteria, (3) managing uncertainties for project evaluation against one specific criteria, (4) interdependency of projects within a portfolio, (5) uncertainty of resource availability from the planning stage to implementation phase, (6) managing and balancing factors in the selection process, and (7) selecting from the many possibilities of project combination (Ghasemzadeh 1998, p. 2-4). To address the abovementioned issues and select an optimal portfolio of projects, an organisation should develop a systematic and comprehensive approach in planning, implementing and controlling the selection process including a formal method for the evaluation of new and existing portfolio components (Meyer 2014, p. 30). Archer and Ghasemzadeh proposed three stages in the portfolio selection process: (1) pre-process phase includes methodology selection and strategy development, which should be designed based on organisational strategy and a broader range of the organisation's internal and external factors, (2) process phase includes pre-screening, individual project analysis, screening, optimal portfolio selection and portfolio adjustment, (3) post-process phase includes project development and project evaluation (Archer and Ghasemzadeh 2004, p. 247-252). It is important that every criterion, for the evaluation and selection of portfolio components and optimisation of portfolio, links to the organisation's strategic objectives. For example, for effective individual component (projects) analysis, a mix of financial criteria (net present value, internal return rate etc.) and non-financial criteria (employee morale, stakeholder satisfaction etc.) should be used.

Portfolio Prioritisation

PMI (2014, p. 180) defines prioritisation as "a technique to compare and rank selected portfolio components, based on their evaluation scores and other

management considerations, to ensure alignment with organisational strategy and objectives." There are different types of criteria that can be used for evaluating portfolio components and developing their evaluation score, such as financial, technical, risk-based, resource-based etc. (Purnus and Bodea 2014, p. 340). Every criterion used for the prioritisation process should be linked to the organisational strategy and reflect critical success factors, which are developed by an organisation as a form of measurement. In the prioritisation process it is important to develop a prioritisation strategy based on the portfolio strategic management plan and continually align prioritisation decisions with business strategy (Vara 2014, p. 158). Internal and external organisational changes have the potential to affect prioritisation criteria, which are developed based on the business strategy; therefore during the prioritisation process a robust control system should be applied in order to validate the defined criteria as well as monitor all changes that may impact the process.

Portfolio Optimisation

While portfolio evaluation aims at selecting components that meet portfolio selection and prioritisation criteria, portfolio optimisation is used to select components in a portfolio that maximise or minimise a certain factor, such as rate of internal return, net present value, risk or budget, etc. (Meyer 2014, p. 23). PMI (2014, p. 177) defines optimisation as "a process of assessing the portfolio components based on the organisation's selection and ranking processes in order to create the component mix with the greatest potential to collectively support the organisation's strategy and goals". During the portfolio optimisation process, trade-offs of portfolio objectives should be evaluated, portfolio component performance should be measured against portfolio objectives, and a balance of portfolio components should be developed in order to support organisational objectives; therefore portfolio objectives that are developed based on the organisational strategy are the key drivers for the portfolio optimisation process. Portfolio optimisation assists in identifying portfolio components that are not aligned with organisational strategy anymore and reprioritising, suspending or terminating those components (PMI 2014, p. 70). One of the key activities during the portfolio optimisation process is the performance measurement of portfolio components. The same principle of organisational performance measurement can be used for portfolio components such

as balanced scorecards or critical success factors. Also, during the portfolio optimisation process, the key assumption and criteria should be validated.

2.3.2 Portfolio Management Success and Portfolio Performance

Organisations need to have processes, tools and techniques to understand portfolio performance from a corporate level, where portfolio component objectives are connected to an organisation's strategic objectives (Sanchez and Robert 2010, p. 64). "Portfolio success is measured in terms of the aggregate investment performance and benefit realisation of the portfolio" (PMI 2014, p. 5). It means the portfolio success is measured against defined organisational objectives over an extended period of time (Marnewick 2014, p. 123). It is difficult to realise the overall success of a portfolio because a portfolio is a dynamic in nature, includes multiple often-conflicting objectives and it constantly changes and develops over a period of the portfolio life cycle (Jonas 2010, p. 819). Therefore, it is essential to continuously monitor changes, inside and outside of the portfolio, which affect the portfolio success as well as ensure the success criteria are valid over the portfolio life cycle.

Portfolio management literature suggests that portfolio success should be measured multi-dimensionally on project, portfolio and organisational levels (Blomquist, Müller et al. 2006, p. 60); (Müller, Martinsuo et al. 2008, p. 30) and that also it should be realised at different points during the portfolio life cycle (Jonas 2010, p. 827). Fricke and Shenhar (2000, p. 258), by conducting a qualitative study in the manufacturing industry, found that the success factors for the multiple project environment are different from success factors for traditional single projects. In addition, they showed that the definition of clear goals, management support, ownership, prioritisation and resource allocation are dimensional factors for a multi-project environment (Fricke and Shenbar 2000, p. 263). In another study, Shenhar et al. (2001, p. 699) developed a multi-dimensional framework for measurement of project success in multi-project enforcement, including (1) project efficiency (2) impact on customer, (3) direct organisation success and (4) future readiness. Martinsuo and Lehtonen (2007, p. 57) suggested that the efficiency of portfolio management can be identified by measuring the degree of portfolio strategic alignment, portfolio balance and portfolio value. Their study showed that, although there is a direct link between project management efficiency and portfolio management efficiency, there is not a link between project goals and portfolio

management efficiency (Martinsuo and Lehtonen 2007, p. 56). Marnewick (2014, p. 124), based on the studies of Berinber et al. (2013) and Meskendhal (2010), suggested four mutually inclusive main success criteria for project portfolio: (1) maximisation of the financial value of the portfolio, (2) linking portfolio and its component to organisational strategy, (3) average single component success within the portfolio, and (4) selection and balancing the components of the portfolio in line with organisational strategy as well as an organisation's capability and capacities. Müller, Martinsuo et al. (2008, p. 33) identified three portfolio management performance measures:

1. Achieving results includes customer satisfaction, combined time, cost and quality results, financial results and user requirements.
2. Achieving purpose, which measures achieving project and programme purpose
3. Balancing priorities includes resource turnover, timely accomplished programme and stakeholder satisfaction.

Their studies showed that selection of projects for the portfolio in accordance with organisational strategy and objectives increases portfolio performance, and moreover, the relationship between portfolio control and portfolio performance is moderated by contextual factors, including governance type. They proposed that a hybrid organisation, which combines and balances programme and portfolio approaches, has a better performance in portfolio selection, portfolio reporting and portfolio decision making, which contributes to better portfolio performance management (Müller, Martinsuo et al. 2008, p. 38).

Voss and Kock (2013, p. 854), based on the studies of Meskendhal (2010) and Jonas et al. (2013), defined project portfolio success as a multi-dimensional, second-construct consisting of six sub-constructs as follows:

1. Overall business success includes revenue growth, market share and probability.
2. Average of project success includes overall performance of project regarding schedule, cost and quality baselines and degree of customer satisfaction.

3. Future preparedness includes development of new technologies and competencies in portfolios, entering new market and shaping future of organisation by implementation of portfolios.
4. Strategic fit includes alignment of portfolio with organisational strategy and allocation of resources based on the organisational objectives.
5. Portfolio balance includes balance between existing and new technologies, balance between old and new areas of application, balance of project in different implementation phases, balance in portfolio to develop constant cash-flow and balance of project risks in portfolio; and
6. Use of synergies includes use of technical and market synergy and leverage synergy between projects (Voss and Kock 2013, p. 854& 858).

2.4 Contextual Factors

For the first time, Woodward in his landmark book of Management and Technology (Woodward 1958), introduced the organisation contingency theory and claimed that technologies determine differences in organisational attributes (Sauser, Reilly et al. 2009, p. 666). Contingency theory has been evolved by other researchers such as Thompson (1967) who found uncertainties as the main problem of a complex organisation and Drazin and Van de Ven (1985, p. 514), who examined selection, interaction and system approaches to fit in structural contingency theory. The classical contingency theory explained how organisational effectiveness is related to the degree of fit between structural and environmental variables (Shenhar 2001, p. 395).

Organisational Level Contingency Factors

Organisational strategy can be considered as contextual factors that moderate the alignment between an organisation's objectives and portfolio management. Srivannaboon and Milosevic (2006, p. 494), in their project management and business strategy alignment study, used Porter's generic strategies (1980) including (1) cost leadership strategy, (2) differentiation strategy and (3) a combination of two strategies that is called best-cost strategy, which is the best approach to creating a sustainable competitive advantage. The level of an organisatios tendency to take risk and enter into risky ventures (Kock, Heising et al. 2016, p. 119) is another contingent

factor that affects the organisational strategy and organisation strategic control approach. Blomqusit and Müller (2006) categorised organisations into four governance structure types, including (1) the project-oriented organisation that views projects in an isolated way, (2) the programme-oriented organisation that groups projects by common objectives, (3) the portfolio-oriented organisation that manages a series of projects or programmes to achieve organisational objectives, and (4) a hybrid organisation that combines portfolios and programmes for implementation of the organisation's strategy. In their study, they found that hybrid organisations are significantly more successful than other organisations who peruse the other three approaches (Blomquist, Müller et al. 2006). In addition, hybrid organisations have better performance in portfolio selection, portfolio reporting and portfolio decision making and accordingly are more successful in portfolio management (Müller, Martinsuo et al. 2008, p. 35).

Portfolio Level Contingency Factors

While the concept of contingency theory in organisations has been evolved over the last half-century, the application of contingency theory to the project management and portfolio management literature has gradually emerged during the last two decades (Sauser, Reilly et al. 2009, p. 667). In recent years, researchers have paid more attention to portfolio interdependency (Rungi , Elonen and Artto 2003, Stummer and Heidenberger 2003, Collyer and Warren 2009, Dahlgren, Soderlund et al. 2010), including resource, outcome, financial and learning dependencies. In the portfolio management literature, portfolio size and project interdependency have been considered as contingent factors that are related to portfolio management performance (Teller, Unger et al. 2012, Voss and Kock 2013, Kock, Heising et al. 2016). It is widely accepted that organisations need to understand the complexity of a portfolio and interdependency of its components in order to meet stated goals and objectives (Blau, Pekny et al. 2004, p. 232). Teller et al. (2012, p. 597) emphasised formalisation in both single-project management and portfolio management as a contingent factor, which contributes to portfolio management quality and success. They also found this relationship become stronger with the increasing of portfolio complexity (portfolio size and projects interdependency in the portfolio).

Environmental Contingency Factors

Dynamic environments create uncertainties, which make it difficult to define, implement and control portfolios in order to achieve organisational objectives (Petit, Brian et al. 2014, p. 18). Environmental uncertainty is created by (1) environmental instability (rate of environmental changes), (2) environmental complexity (number and diversity of environmental events) and (3) unpredictability of market and industry (Duncan 1972, Miller and Friesen 1983, Fiegener 1990). As environments become more unstable, complex and unpredictable, the need for an effective control system for monitoring of strategy and accordingly, strategy re-formulation, increases. (Ansoff 1980, Camillus 1982, Fiegener 1990). Fiegener (1990, p. 111) claimed that environmental uncertainty is positively related to tightness of all types of strategic control systems, however environmental hostility (crises events) is negatively related to tightness of feedback and feedforward controls.

Teece et al. (1997, p. 516), in their seminal article, defined an organisation's dynamic capabilities as "the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments." Therefore, it is important that an organisation balance its resources and control their performance in order to overcome environmental changes. In the portfolio management literature, there are evidences that the portfolio can be considered as a driver for dynamic capability (Killen, Hunt et al. 2008, Petit and Hobbs 2010, Martinsuo and Killen 2014).

Dahlgren et al. (2010, p. 18), in researching four Swedish organisations, found that different types of organisation peruse different types of control systems based on the level of uncertainty and the level of dependency between projects. Figure 9 shows their proposed model. When uncertainty is high, the defined plan is vulnerable to environmental changes; therefore for achieving the stated objectives, organisations need to carefully optimise their resource allocation. When both uncertainty and project dependency are high, coordination between dependencies is required in addition to resource-based controls. Progress meetings are arranged on a frequent basis to solve dependencies and detect coordination errors in the project portfolio.

		Project Uncertainity	
		Low	High
Dependency Between Projects	Low	Routine-based Control	Resource-based Control
	High	Planning-based Control	Programme-based Control

Figure 9: Control Model in Multi-project Organisation (Dahlgren, Soderlund et al. 2010, p. 18)

2.5 Summary and Implications

The purpose of this literature review was to analyse the theoretical and empirical literature about strategic control processes in organisation, portfolio management concept and theories, portfolio management performance, and contextual factors related to the research domain.

Strategic control concept: in the first part of this section, the traditional (operational) control system and the strategic control system were compared and the need for a modern strategic control concept in organisation was investigated. It followed with a comprehensive review of different theories and concepts of strategic control systems and the development of modern strategic control in organisations. Four different types of strategic control including premise control, implementation control, strategic surveillance and special alert control have been identified from the literature and their characteristics were presented in order to use them for development of the research model and research hypotheses. The focus of all the existing literature in strategic control management is on the control of strategy formulation and strategy implementation in organisations to ensure that stated objectives, goals and targets are being met. There is no evidence in the literature that shows the formal deployment of a strategic control mechanism in portfolio management as a temporary or permanent organisation. Two methods for the implementation of strategic control in an organisation - balanced scorecard and critical success factors - were presented. Those methods link operational control and strategic control, and enable organisations to comprehensively measure their performance over an extended period of time, both from financial and non-financial

points of view. The balanced scorecard method generally is adopted and is tailored by some organisations to measure the performance of their portfolios of projects (Pearce and Robinson 2011, p. 365). Moreover, scholars have been investigated the use of key performance indicators in portfolio management performance (Sanchez and Robert 2010, p. 65). Review of the literature showed there is no a common theoretical or practical foundation between academia and practitioners for analysing the use of strategic control in portfolio management and development of a comprehensive framework.

Project portfolio management performance: the definitions of project portfolio and project portfolio management from a corporate point-of-view were reviewed and related literature was presented. The importance of defining, implementing and controlling the portfolio based on the organisational strategy were highlighted. The concepts of portfolio control and definition of portfolio management performance and their relationship were investigated. The study also reviewed literature on the portfolio selection and portfolio optimisation as a control mechanism in the portfolio, and effective instruments that are supposed to assist in achieving organisational goals. Beside portfolio management performance being reviewed, it was indicated that it would be important to measure portfolio performance by multidimensional factors and from project, portfolio and corporate levels. In summary, the literature reviews showed knowledge gaps in (1) application of strategic control systems in the portfolio environment, (2) how using strategic control systems in portfolios contribute to portfolio success and efficiency, and (3) how the relationship between use of strategic control in the portfolio and portfolio management performance is moderated by different contextual factors.

Contingent variables: the type of control system that is used in organisations in order to monitor and control organisational activities, including portfolio definition and implementation, is varied based on the contextual factors. Also, there is evidence that researchers have investigated the relationship between portfolio control and portfolio management performance in different contexts (Nobeoka and Cusumano 1995, Blomquist, Müller et al. 2006, Martinsuo and Lehtonen 2007, Müller, Martinsuo et al. 2008). In this research, contingent variables are selected from three different levels including environmental contingent variables, organisational level contextual factors and portfolio level contingent variables.

2.6 Research Questions and Hypotheses

The research gaps are identified through literature review and are summarised in Section 2.5, showed there is no evidence in the literature explains the formal deployment of a strategic control mechanism in portfolio management as a temporary or permanent organisation. Moreover, it showed the impact of using strategic control mechanisms at portfolio level on portfolio performance is an unstudied area. Therefore, the main motivation behind this study is the need for further understanding of portfolio control and its effectiveness for portfolio success. The first objective of this study is to review the use of strategic control mechanisms at portfolio level within organisation. To achieve this objective, it is important to understand the issue of applying the strategic control in a portfolio of projects. This leads to the definition of the first research question that this study hopes to answer:

A. How are portfolios strategically controlled and what kind of strategic control mechanism may be deployed in portfolios?

Projects within a portfolio share budget and resources, and have some degree of alignment with respect to scope and content. The literature translate the competition of projects for resources and their alignment in scope and content as "portfolio interdependency" (Teller, Unger et al. 2012, p. 606), (Voss and Kock 2013, p. 859) and (Kock, Heising et al. 2016, p. 128). The portfolio interdependency and portfolio size are major factors shaping portfolio complexity (Nobeoka and Cusumano 1995, Dahlgren, Soderlund et al. 2010, Teller, Unger et al. 2012, Voss and Kock 2013, Petit, Brian et al. 2014, Kock, Heising et al. 2016). In addition, changing environment and portfolio surrounding situations impact portfolio and the interaction of projects within the portfolio (Collyer and Warren 2009, p. 355). The level and robustness of control system require to measure performance of a portfolio in an efficient and effective manner, are defined based on the portfolio characteristics including portfolio complexity and portfolio dynamic. Therefore, Question A can be divided into the following sub –questions by considering two major portfolio characteristics:

<u>*Research question 1:*</u> *Is there any relationship between use of strategic control processes in portfolio and portfolio complexity?*

Research question 2: Is there any relationship between use of strategic control processes in project portfolio and portfolio dynamic?

Based on the abovementioned research questions the following research hypotheses are developed:

Research hypothesis 1: Use of strategic control in a portfolio is directly related to portfolio complexity;

Research hypothesis 2: Use of strategic control in a portfolio is directly related to portfolio dynamic;

The second objective of this study is to investigate the impact of using strategic control in portfolio on portfolio performance in different situation. Therefore, the second research question could be read as follows:

B. How does strategic control relate to portfolio management performance and what are the moderating contextual factors?

"Portfolio management performance is measured in terms of the aggregate investment result and benefit realisation of the portfolio" (PMI 2014, p. 5)". Voss and Kock (2013, p. 859) and Teller et al. (2012, p. 606) measured portfolio performance by a series of tangible and intangible factors include: the impact of portfolio on overall project success, contribution of each project within portfolio to the portfolio performance, portfolio balance and the degree that portfolio fits within parent organisation. Those performance indicators are influenced by portfolio characteristics such as portfolio size, portfolio interdependency and portfolio dynamic.

The research Question B can be divided to the following sub –questions based on the portfolio characteristics:

Research question 3: Is there any relationship between use of strategic control processes while implementing portfolio objectives and project portfolio management performance?

Research question 4: Is there any difference between the performance of a portfolio in which the portfolio manager deploys strategic control, and the performance of a portfolio in which the portfolio manager does not use strategic control?

Research question 5: What is the moderating effect of portfolio size on the deployment of strategic control in portfolio and project portfolio performance?

Research question 6: What is the moderating effect of portfolio interdependency on the deployment of strategic control in portfolio and project portfolio performance?

Research question 7: What is the moderating effect of the portfolio dynamic on deployment of strategic control in portfolio and project portfolio performance?

The following hypotheses are drived from each of the abovementioned research questions respectively:

Research hypothesis 3: There is a positive relationship between use of a strategic control system in a portfolio while implementing portfolio objectives and portfolio management performance;

Research hypothesis 4: Portfolios in which portfolio managers deploy strategic control systems have better performance than portfolios in which portfolio managers deploy only traditional control systems;

Research hypothesis 5: The portfolio size positively moderates the relationship between use of strategic control in portfolio and portfolio management performance;

Research hypothesis 6: The portfolio interdependency positively moderates the relationship between use of strategic control in the portfolio and portfolio management performance;

Research hypothesis 7: The portfolio dynamic positively moderates the relationship between use of strategic control in portfolio and portfolio management performance;

Project portfolio governance as another major characteristic of portfolio is defined as a series of plans, processes, tools and techniques, which are developed based on the organisational strategy and are used to identify, select, prioritise and monitor projects within an organisation. (Barker 2014, p. 87). Blomquist and Müller (2006) identified four type of portfolio governance within organisations: (1) multi-project, (2) portfolio driven, (3) programme driven and (4) hybrid organisation as explained in Chapter 2. Since portfolio governance type could be considered as fourth factor moderating the relationship between portfolio strategic control and

portfolio performance in addition to portfolio size, interdependency and dynamic. Therefore, the last research sub-question and last hypothesis are formulated as follows:

Research question 8: What is the moderating effect of a governance type of organisation on deployment of strategic control in portfolio and project portfolio performance?

Research hypothesis 8: The governance type of the organisation positively moderates the relationship between use of strategic control in a portfolio and portfolio management performance;

High-level Research Model

This study used the following concepts from strategic control and project portfolio performance management literature for development of the research model:

1. Strategic control model and its components are borrowed from Preble's strategic model (1992, p. 395);
2. The purpose, characteristics and functionality of different strategic control types are borrowed from Pearce and Robinson (2011, p. 365), Schreyögg and Steinmann (1987, p. 100) and Preble (Preble 1992, p. 404);
3. The concept of portfolio control, its link to project portfolio performance and moderating contextual factors are borrowed from Müller, Martinsuo et al. (2008, p. 38);
4. Project portfolio performance indicators are borrowed from Voss and Kock (2013, p. 859), Marnewick (2014, p. 125) and The Standard for Portfolio Management (PMI 2014, p. 84);

The relationship between portfolio strategic control and portfolio management performance in different contexts is the foundation of the research model that is shown in Figure 10. Portfolio strategic control as an independent variable is hypothesised to impact on portfolio performance as a dependent variable, and context variables moderate this relationship.

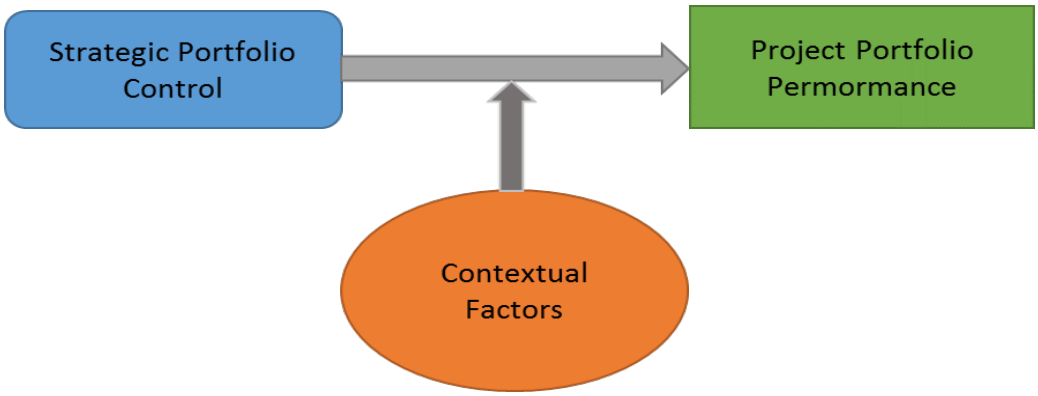


Figure 10: High-level Conceptual Research Model

Chapter 3: Research Design

This chapter describes the methodology selected by this study to achieve the stated research goals and objectives. Section 3.1 discusses the research design, explains methodology used in the study, presents conceptual and operational definitions of variables and states the research assumptions; section 3.2 details the data source and participants in the study and explains the selection methods and criteria; section 3.3 presents instruments used in the study and provides justifications; section 3.4 discusses the procedure used in the research and then presents the study timeframe; section 3.5 discusses how the data was analysed and provides details on statistical methods that were used in this study ; and finally, section 3.6 discusses the ethical considerations and limitations of the study and presents research strengths and weaknesses.

3.1 Methodology and Research Design

3.1.1 Methodology

This study is an applied research study in the field of portfolio management and strategic management. Its purpose is to review and analyse use of strategic control mechanisms in portfolio management, in order to understand the influence of those functions on portfolio performance.

Because portfolio strategic control is an unstudied area, this study is inductive, meaning it tries to understand use of strategic control in a portfolio with an analysis of empirical data. This study is non-experimental, essentially exploratory and explanatory in nature. A solid and simple research method is proposed, which relates strategic control variables to portfolio management performance variables, to measure portfolio performance and success in different context.

To complete this research study, the following sequential overlapping research phases are integrated:

1- Data gathering conducted by qualitative method and analysing the data in order to define a basic understanding of portfolio strategic control concept in an organisation and its contribution to portfolio management performance.
2- Data gathering performed by quantitative approach and analysing the data in order to examine the research hypotheses and develop the final research model to address the use of strategic control mechanism in a portfolio environment, and to define the relationship between strategic portfolio control and portfolio performance by considering the moderating factors.

Since the characteristics of strategic portfolio control are not well understood, and also research questions are investigating how this phenomenon is interpreted and is managed, it is important to clarify the context and understand organisations where the events are taking place. Therefore, it is proposed to study organisations in order to understand how target organisations strategically control their portfolio and what control practices they use to improve performance of their portfolios. This qualitative study process consists of (1) analysis of the organisations' documents including process descriptions, control procedures, strategic management and portfolio management documents and (2) conducting personal interviews with key people who

are involved in strategy formulation, implementation and evaluation, and people who are responsible for portfolio execution in organisations. These two approaches play an essential role in understanding the real situation within organisations regarding use of strategic control mechanisms in the portfolio environment and also developing appropriate hypotheses for the research. In addition, this assists in gathering information from multiple sources, which are more valuable and trustworthy than those obtained from a single source, and provide informational redundancy or saturation during data gathering. Evidence used in this research was developed during organisation life cycles, for example, organisation's long-term, medium and short-term strategic management plans, portfolio management plans, financial statements, etc. Personal interviews were conducted during this research life cycle, therefore this researcher plays an important role in connecting and relating date-certain evidence with evidence that is not date-certain.

For the second part of the research, an explanatory (correlational) survey method is used in order to collect information from the broader range of cases to test the research hypotheses. To conduct this part of the study, it is important that the theoretical model underlying the research design is clearly defined and hypotheses are completely understood. Then, survey questionnaires are developed based on findings of qualitative parts and are validated by a research supervisory team and a group of industrial experts who attended the qualitative part of the research. The target population for the quantitative part is identified by this researcher and three individuals who attended the research interviews.

The Figure 11 shows the overall process of the research methodology:

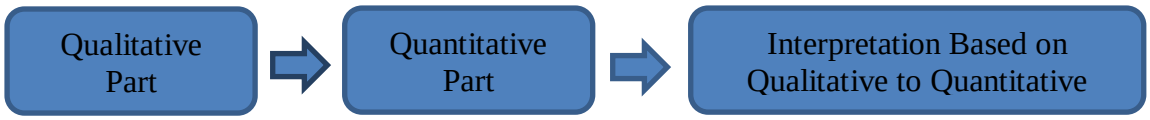


Figure 11: Overall Research Methodology

3.1.2 Research Design

A sequential dual research approach was selected for this research study, combining qualitative and quantitative techniques in order to obtain an optimum level of quality and credibility. The rationale behind the selection of this methodological approach was based on the flaws of each of the quantitative and

qualitative methods (McGrath 1981, p. 24). For example, quantitative questionnaires are not able to capture the whole picture of events and the relationship among variables (Bryman, Stephens et al. 1996, p. 354). Qualitative data gathering and semi-structured interviews help in understanding the full richness of the interactions among events (Van der Velten 1997, p. 104).

The qualitative part of this research was used to obtain a basic understanding of the portfolio strategic control concept in an organisation and its contribution to portfolio management performance. This helped to find how organisations use strategic control mechanisms in their portfolio management process and what control practices they use to improve their portfolio performance, while quantitative data were used to examine the research hypotheses and to ensure accurate analysis without bias. In addition, qualitative information was obtained from interviews and provided richness to the quantitative findings.

Qualitative Part: A multiple case study method was used for the execution of the qualitative part of this research, as multiple-case sampling adds confidence to findings. For a qualitative study, it is important to select cases based on the study purpose and strategically based on the research objectives (Patton and Patton 2002). Based on the theoretical sampling methodologies (King, Keohane et al. 1994, Patton and Patton 2002, Corbin and Strauss 2015), three strategies were chosen for selection of research sample:

Criterion Sampling: the following criteria are used to identify and select cases for the study:

- Organisations should be selected from the most mature companies in their industry in order to represent best practices;
- Organisations should be among both clients and contractors in order to capture a variety of views regarding the research topic;
- Organisations should have some form of management control mechanisms for evaluation of their portfolio performance;

In criterion sampling, it is important to select the criteria carefully, so as to define cases that will provide detailed and rich data relevant to the particular research problem; in this situation, criterion sampling can provide an important qualitative component to quantitative data.

Intensity Sampling: Intensity sampling can allow the selection of a small number of rich cases that provide in-depth information and knowledge of a phenomenon of interest.

- Firms should have the contingent variables on two sides of a continuum (e.g. low uncertain environment firms and high uncertain environment firms).

Snowball Sampling: this approach involves utilising well-informed individuals to identify cases or informants who have knowledge about a phenomenon. As this researcher had a large network of professionals with great knowledge of portfolio management and strategic control processes, this approach was helpful in order to identify and accumulate critical cases.

The qualitative part of this research studied the nature of alignment in market-leading organisations and collected empirical data through the following sources:

I. Interviews with individuals holding key organisational positions. This approach is the main instrument for collecting data in the qualitative part. The format of the interviews was semi-structured with a specific list of open-ended questions. Content analysis was used to review and to categorise the responses to open-ended questions.

II. Organisations' documents including organisation vision and mission statements, organisational standard processes, policies, procedures and any document related to strategic control and portfolio management processes.

III. Observation on the organisations' strategic meetings and workshops, annual report presentations and portfolio progress steering committee meetings.

Quantitative Part: The quantitative part of this research examined hypotheses by statistical instruments. A survey questionnaire was used to collect the data from entire target group of 174 individuals who hold key organisational roles in world-class, high performing industry firms. The constructs of the quantitative part of the research are measured by relating them to the survey questionnaire. The contents of the survey and operationalisation of the variables are developed based on the literature and interviews conducted in qualitative part.

The conceptual definition and operational definition of variables, which are extracted from the literature review and interviews conducted in the qualitative part of the research, are presented as follows:

Strategic Control

Conceptual definition: Strategic control is a means of evaluating the organisation's plans and activities and defining future actions to keep the organisation on track for its strategic movement (Preble 1992, p. 393).

Operational definition: Organisations were reviewed by conducting interviews to understand how they apply four different types of strategic control in their portfolios in order to achieve stated objectives. The following operational definitions were captured from interviews and the literature review:

1- Premise Control: the use of premise control in a portfolio is measured as the arithmetic mean of the responses of each participant to the four following statements. The respondents were asked to rate each of the statements from 1 (strongly disagree) to 5 (strongly agree) based on the 5-point Likert Scale.

   A. We formulate premises about the internal and external portfolio environment during portfolio defining process. (PRC-A)
   B. We conduct stakeholder analysis. (PRC-B)
   C. We continuously and systematically monitor portfolio environment to ensure assumptions are valid. (PRC-C). This includes market situation, political situation, market position, budgetary constraints and etc.
   D. We select and prioritise portfolio components based on the defined assumptions. (PRC-D)

2- Implementation Control: the use of implementation control in a portfolio is measured as the arithmetic mean of the responses of each participant to the four following statements. The respondents were asked to rate each of the statements from 1 (strongly disagree) to 5 (strongly agree) based on the 5-point Likert Scale.

   A. We conduct milestone reviews as per the portfolio management plan.(IMC-A)

B. We measure portfolio performance and its components by balanced scorecard or critical success factors methods. (IMC-B)
C. We identify critical components in portfolio, review those components by operational control instrument and use the results to decide about overall portfolio direction. (IMC-C)
D. We optimise portfolio and balance portfolio components during portfolio aligning process. (IMC-D)

3- Strategic Surveillance: the use of strategic surveillance in a portfolio is measured as the arithmetic mean of the responses of each participant to the three following statements. The respondents were asked to rate each of the statements from 1 (strongly disagree) to 5 (strongly agree) based on the 5-point Likert Scale.
   A. We develop high quality portfolio environmental information for early identification of strategic risks/issues and their potential impacts. (SSC-A)
   B. We anticipate trends and events that may affect portfolio objectives. (SSC-B)
   C. We develop a series of actions in order to manage risks and issues. (SSC-C)

4- Special Alert Control: the use of special alert control in a portfolio is measured as the arithmetic mean of the responses of each participant to the following statements. The respondents were asked to rate each of the statements from 1 (strongly disagree) to 5 (strongly agree) based on the 5-point Likert Scale.
   A. We monitor portfolio environment and identify high impact events with low probability that may provide crises in a portfolio and accordingly in an organisation. (SAC-A)
   B. We have a team in our portfolio who work with the crises management team in the organisation to develop required plans, actions, tools and techniques in order to respond to portfolio crises and evaluate the whole direction of the portfolio (SAC-B)

Portfolio Complexity

Conceptual definition: in the literature, portfolio complexity is considered as portfolio size and project interdependency (Nobeoka and Cusumano 1995, Dahlgren, Soderlund et al. 2010, Teller, Unger et al. 2012, Voss and Kock 2013, Petit, Brian et al. 2014, Kock, Heising et al. 2016).

Operational definition: in this research, portfolio complexity is measured by the following criteria:

1- Portfolio interdependency, which includes four items that are borrowed (Teller, Unger et al. 2012, p. 606), (Voss and Kock 2013, p. 859) and (Kock, Heising et al. 2016, p. 128). Portfolio interdependency is measured as the arithmetic mean of the responses of each participant to the following six statements. The respondents were asked to rate each of the statements from 1 (strongly disagree) to 5 (strongly agree) based on the 5-point Likert Scale.
   A. Projects share resources, including employees and expertise. (PCO-A)
   B. Projects share an overall budget. (PCO-B)
   C. There is a high degree of alignment between our projects, with respect to scope and content. (PCO-C)
   D. Delays in individual projects inevitably impact other projects. (PCO-D)
   E. Some deliverables in one project are necessary to start one or more tasks in other projects. (PCO-E)

2- Portfolio size: respondents were asked to answer how high the annual budget of the project portfolio is, and to select one of the following five categories.
   A. Portfolio annual budget is less than US$20m. (PZI-A)
   B. Portfolio annual budget is between US$21m and US$100m. (PZI-B)
   C. Portfolio annual budget is between US$101m and US$300m. (PZI-C)
   D. Portfolio annual budget is between US$301m and US$1000m. (PZI-D)
   E. Portfolio annual budget is over US$1000m. (PZI-F)

Portfolio Dynamic:

Conceptual definition: **"**in the project management context, dynamism is taken to be a dimension of a project that represents the extent to which a project is influenced by changes in the environment in which it is conducted" (Collyer and Warren 2009, p. 355).

Operational definition: in this research, portfolio dynamic is measured by factors borrowed from Collyer and Warren (2009, p. 357) and Fiegener (1990, p. 136). The respondents were asked to rate each of the statements from 1 (strongly agree) to 5 (strongly disagree) based on the 5-point Likert Scale.

A. The stated portfolio objectives, targets and goals change regularly over a portfolio lifecycle. (PDY-A)
B. There are high levels of the unknown at the start of the portfolio and high rates of new unknown throughout the implementation phase. (PDY-B)
C. To keep the portfolio alignment, priorities shift regularly over the portfolio lifecycle. (PDY-C)
D. Strategic changes of one portfolio have heavy potential impact on other portfolios in the organisation. (PDY-D)
E. There are not sufficient skills and experts available within the portfolio. (PDY-E)

Portfolio Management Performance:

Conceptual definition: "Portfolio management performance is measured in terms of the aggregate investment result and benefit realisation of the portfolio" (PMI 2014, p. 5).

Operational definition: Portfolio management performance is measured using variables that are borrowed from Voss and Kock (2013, p. 859) and Teller et al. (2012, p. 606). Those factors consist of average project success, portfolio balance, strategic fit, and overall business success.

1- Overall business success: The respondents were asked to rate each of the four following statements from 1 (poor) to 5 (outstanding) based on the 5-point Likert Scale.

A. How do you evaluate the success of your organisation compared to your competitors regarding overall business success? (POS-A)
B. How do you evaluate the success of your organisation compared to your competitors regarding the revenue growth? (POS-B)
C. How do you evaluate the success of your organisation compared to your competitors regarding profitability? (POS-C)
D. How do you evaluate the success of your organisation compared to your competitors regarding market share? (POS-D)

2- Average project success: The respondents were asked to rate each of the four following statements from 1 (strongly disagree) to 5 (strongly agree) based on the 5-point Likert Scale.
    A. On average our projects achieve a high schedule adherence. (PAS-A)
    B. On average our projects achieve a high budget adherence. (PAS-B)
    C. On average our projects achieve a high quality adherence. (PAS-C)
    D. On average our projects are completed with a high degree of stakeholder satisfaction (PAS-D)
3- Portfolio balance: The respondents were asked to rate each of the four following statements from 1 (strongly disagree) to 5 (strongly agree) based on the 5-point Likert Scale.
    A. There is a good balance in our project portfolio of project risks. (PBA-A)
    B. There is a good balance in our project portfolio between new and old areas of application. (PBA-B)
    C. There is a good balance in our project portfolio to generate a constant cash-flow. (PBA-C)
    D. There is a good balance in our portfolio of projects in different implementation phases (early/late phases). (PBA-D)
4- Portfolio strategic fit: The respondents were asked to rate each of the three following statements from 1 (strongly disagree) to 5 (strongly agree) based on the 5-point Likert Scale.
    A. The project portfolio is consistently aligned with the future of the company. (PSF-A)
    B. The corporate strategy is being implemented ideally through our project portfolio. (PSF-B)
    C. Resource allocation to projects reflects our strategic objectives. (PSF-C)

Governance Type:

Conceptual definition: Project portfolio governance is defined as a series of plans, processes, tools and techniques, which are developed based on the organisational strategy and are used to identify, select, prioritise and monitor projects within an organisation. (Barker 2014, p. 87).

Operational definition: Organisation governance type for this research is borrowed from Blomquist and Müller (2006) where they showed that there are four types of organisation with respect to implementation of governance through their portfolio management system (Müller, Martinsuo et al. 2008, p. 31). That governance consist of (1) multi-project, (2) portfolio driven, (3) programme driven and (4) hybrid organisation. For this research, the respondents were asked to rate each of the three following statements from 1 (strongly disagree) to 5 (strongly agree), based on the 5-point Likert Scale.

A. Multi-project organisation: Projects in an organisation do not share resources and do not have related objectives. (GOV-A)

B. Programme driven organisation: Projects in an organisation do not share resources, but have related objectives. (GOV-B)

C. Portfolio driven organisation: Projects in an organisation share resources, but do not necessarily have related objectives. (GOV-C)

D. Hybrid organisation: Projects in an organisation share resources and have related objectives (GOV-D)

Assumptions:

The basic assumptions underlying this methodology are:

- All interviewees and respondents to survey questionnaires answered the questions truthfully and to the best of their knowledge and ability;
- The respondents were able to recall accurately all events and facts regarding the open-ended questions in the qualitative part;
- All archive and documentary data provided by organisations were accurate and reflected the organisation's vision, mission and objectives; and
- Since the author of this research has been working in the energy industry for 15 years, his views regarding the research topic were reflected in the interpretation of an organisation's documents and in developing interview questions and survey questionnaires;

3.2 Data Source and Selection

Source of Qualitative Data: A series of semi-structured interviews were held with ten individuals in seven different organisations by asking prescribed questions and using a predetermined interview protocol. The interviews were held either face-to-face or through conference calls and were tape recorded for subsequent analysis. In order to obtain reliable and quality information regarding organisations' strategies, control management process and their operation portfolios, entire target groups were selected from the highest positions in organisations. All companies operate worldwide and are leading firms in their industry. Annual revenue of the organisations ranged from US $214million to US $18.8billion in 2014. Details about company type, industry, geographical location and other related information can be found in Table 3.

The following procedures were used for collecting the qualitative data:

I. After a brief introduction of the research and explanation of the nature of the questionnaire, the interviewees were requested to respond to the open-ended questions. The list of questions are presented in Appendix A. Each interview lasted between 50 minutes and 2.5 hours, with average duration of 90 minutes. All interviews were tape recorded and key notes taken throughout the interviews by the researcher.

II. All recorded interviews were transcribed and then were sent to interviewees for review, to verify the accuracy of the transcriptions so as to enhance the validity of the research.

III. All transcribes were reviewed by legal departments of the respective organisations in order to obtain approval for using the collected information.

Industry	Type of Organisation	Title of Interviewee	Location of Interviewee
1-Energy	Oil & Gas Downstream and Upstream Operation	Chief Executive Officer Vice President	Australia Australia

2-Energy	Oil & Gas Chemical Petrochemical Renewable Energy Nuclear Energy	Vice President General Manager Portfolio Director	France Singapore Saudi Arabia
3-Energy	Consulting in Oil, Gas and Nuclear Energy	General Manager	United Kingdom
4-Energy	Petrochemical Chemical	Vice President	Qatar
5-Utilities	Gas & Electricity	Portfolio Manager	Canada
6-Construction	Energy & Mining	Vice President	USA
7-Construction	Energy & Infrastructure	Portfolio Director	China

Table 3: Industry, Type of Company, Country and Role of Interviewees

Source of Quantitative Data: A worldwide survey questionnaire consisting of fourteen questions was used to collect data for the quantitative part. The list of questions is presented in Appendix B. A list of 56 companies was provided in the first stage, and after communication with companies, 48 firms agreed to attend the study. The number of the attendees totalled 170 from 48 organisations. The questionnaires were sent through email to a contact person provided by the respected company. Each questionnaire was accompanied with an introduction letter, introducing research, researcher team and explaining the purpose of the study General demographic information regarding respondents is presented in Section 4.1.

3.3 Instruments

The data for the qualitative part of this study were collected though:

I. Interview: personal interview with individuals who hold key positions in the selected organisation. For these interviews a specially designed questionnaire with 8 open-ended questions and 20 sub-questions was

used. The details of questions are presented in Appendix A. The first revision of the questionnaire was reviewed for construct and content by the supervisory team and two industry professionals who are experts in either the portfolio management field or in the strategic management process. A number of adjustments were made, including translation of scientific terms into more common business and industrial language and changing the sequence of questions. At the final stage the interview questionnaire was approved by the supervisory team and the Queensland University of Technology ethics committee.

II. Researcher observation: the researcher as an observer has the opportunity to attend fourteen meetings and workshops held in three out of seven companies. Those meeting consisted of a strategic steering committee meeting, portfolio performance review meetings, annual progress meetings for strategic projects and portfolio workshops, strategic surveillance workshops, and major portfolio risk and opportunity workshops. Observations assisted the researcher to obtain a better understanding of the organisation's culture, norm, dynamic, power structure and informal process, as well as providing a bridge between respondents' answers to interview questions and real processes that are implemented in the organisations. None of the meetings were allowed to be tape recorded, however the researcher kept a journal of those meeting and used approved minutes of meetings for subsequent review, analysis and interpretation.

III. Review of organisational process assets: standard processes, procedures, archival, and documentary data, financial and progress reports were collected from selected organisations.

IV. Survey Questionnaires: The data for the quantitative part of this study were collected though a self-reporting survey questionnaire that measured research variables (Appendix B). Survey questions were prepared based on the data captured by qualitative analysis and information extracted from literature. The questionnaire was reviewed by two academic experts in the field of strategic management and portfolio management, as well as three industry professionals who had

excellent experience in delivery of successful portfolios over the last twenty years and one industry consultant who is an expert in organisations' strategic control processes and who has implemented strategic control system in three different companies. The questionnaire was reviewed and was finalised by the research supervisory team before distribution.

3.4 Procedure and Timeline

The research procedures followed in this study consisted of following steps:

I. Preparation: the research proposal was presented to four executive directors in two different oil & gas companies in order to get support for the study and to have access to people in the industry who could be potential interview subjects. The initial planning and set up for interviews was completed on September 2014 once the informal confirmation was received from eight people who hold high managerial positions in four different companies.

II. Qualitative Data Collection: the research interview questionnaire was approved by the Queensland University of Technology Ethics Committee on June 2015 and data collection by conducting interviews started immediately. Research packages including letter of introduction, one page research proposal and interview questions were sent to a total of ten interviewees and they were asked to review the interview questions before attending the interview. The qualitative part including interviews and data collection through meeting observation and organisation process assets was conducted between June 2015 and November 2015.

III. Qualitative Data Collection: in parallel with qualitative data collection and data analysis, the survey questionnaire was planned, piloted and refined. Potential respondents were identified and the required approvals from the target organisation were obtained. Survey questionnaires were distributed via email to respondents and they were asked to return responses in a maximum of two weeks time.

Quantitative data collections were conducted between December 2015 and February 2016. Analysis of the quantitative data and results triangulation were conducted between February 2016 and May 2016. Subsequently, the final findings and results were developed.

3.5 Analysis

Qualitative Analysis: the interviews were tape recorded, transcribed, reviewed and updated by interviewees for accuracy, then run through a content analysis in order to categorise the responses to open-ended questions. The analyses of interview responses and information were gathered through document review, assisting in understanding the nature of strategic control in organisation and the practices, tools and techniques organisations use to control their portfolios strategically. In addition, this helped in operationalisation of research variables and designing the quantitative survey questionnaire.

Quantitative Analysis: the data collected through survey questionnaires were coded in order to be used in statistical analysis. The following steps were taken for preparation of data before data were imported to the Statistical Software Package:

I. Data Coding: for collected data, numbers were assigned in order to measure the research variables;

II. Conducted exploratory data analysis (EDA) in order to summarise the data set and uncover underlying structure;

The following statistical methods were applied in order to analyse data with the Statistical Package for Social Sciences (SPSS):

I. Pearson's *r* test was used in order to measure the linear correlation between variables and to find the significance of the relationship between variables;

II. Student's t-test method was used in order to find significant differences between the means of each of the portfolio performance variables for any two distinct groups;

III. Analysis of variance (One-way ANOVA) in combination with the Scheffe procedure was performed in order to analyse the difference in the means of performance for four distinct groups;

IV. Multiple regression analysis was used to measure the effect of independent variables on dependent variables and also the impact of moderating effect on the interaction between dependent and independent variables;

V. Cronbach's coefficient *alphas* reliability was performed in order to estimate the satisfactory internal consistency reliability.

3.6 Ethics and Limitations

3.6.1 Ethics

Every step of the data collection of this study followed ethical considerations and all the processes were approved by the Research Ethics Committee of Queensland University of Technology. The following ethical considerations were taken to protect participants in this research study:

1- The researcher used Queensland University of Technology web mail to communicate with participants.

2- Every participant interviewed signed a consent form to indicate that the participation was voluntary and that they had been informed of the objectives of the research, procedures, instructions, possible risks and opportunities, and assurance of anonymity.

3- Discussion was held with the participants and the corporate legal team of the target organisations regarding the method of gathering and using of data. It was decided that participants would answer the questions as long as they were comfortable. It was agreed that participants seek advice from their legal team or higher manager if they were not sure how to answer the questions.

4- All the recorded material and transcripts were sent to participants and their corporate legal team before analysing the materials.

5- The information gathered during the interviews and quantitative survey was confidential and only the members of the research team had access to the audio tapes and the content of their transcriptions.

6- Non-disclosure agreements were signed by the researcher and selected organisations regarding organisation financial data.

3.6.2 Limitations

The scope of this study was limited to the research problems which were discussed in Chapter 2. The following items describe the resulting limitations of this research:

1- The subjects interviewed were high level managers of large and medium-sized international business firms;

2- The scope for qualitative data gathering of this research including interviews was limited to Energy (including: Oil, Gas, Petrochemical and Chemical Sectors), Construction and Utility Industries;

3- The scope for quantitative data gathering of this research was limited to Energy (including: Oil, Gas, Petrochemical, Chemical and Renewable Energy Sectors), Mining, Construction, Utility, IT and Financial Industries.

4- The responses by each participant in the interviews were completely dependent on his or her personal perceptions and experiences.

3.6.3 Strengths and Weaknesses

The research methodology was evaluated, and strength and weaknesses of the methodology are presented as below:

Strengths:

1- Interviews were conducted with high level executives who are completely aware of organisational mission, vision, strategic objectives and standard processes and procedures, therefore responses that were obtained are reliable and reflect the organisation's view;

2- Responses to the quantitative part of the research, were obtained from high performing organisations, which allows identification of best practices for applying strategic control in portfolios;

3- The research samples are gathered from worldwide organisations (130 responses from 48 organisation in different geographical locations), which support development of theory from a general level;

4- Use of a dual research approach and a combination of qualitative and quantitative methods is stronger than a single method;

5- All survey and interviews were completed in a natural environment;

Weaknesses:

1- Portfolio performance was measured from the perspectives of a maximum of three stakeholders in organisations; the views of other stakeholders, including customers, were not considered.

2- Qualitative part of this research is heavily reliant on individual perceptions and views;

3.7 Summary

This chapter described the research methodology and research design, including data source and collection methods, analysis approach and instruments used. It was explained that the research design is a sequential dual approach combining qualitative and quantitative methods together to take the utmost advantage of both methodologies. The qualitative part of the study consisted of ten semi-structured interviews with high executive managers from seven successful organisations. The qualitative part assisted in development of quantitative survey questionnaires and added richness to the quantitative findings. Primary data for the quantitative part of the study were collected through questionnaires sent to the companies under study. The total of 130 responses out of 174 distributed questionnaires was used for data analysis. All research variables were operationalised based on the literature and interviews and each of the variables are defined by a set of factors, which were rated according to the 5-point Likert Scale.

Chapter 4: Results

Chapter 4 presents the result of data analysis of the study about the use of a strategic control system in portfolio management, the relationship between use of strategic control in portfolio and portfolio management performance, as well as moderating effect.

4.1 Survey Demographics

For this study, 174 survey questionnaires were distributed to 48 different organisations worldwide (refer to Figure 15 for details of geographical locations) and a total of 136 completed questionnaires were returned. From the total of 136 responses, only 130 responses were used in the data analysis process as there was information missing and/or faults in the excluded five responses. Thus, the response rate for this study is 78%.

Figures 12 to 18 present the demographic information for the respondents and the organisations they represent.

Age of Respondents: 12% of respondents were under 40 years, 27% between 41-50 years, 43% were between51-60 and 18% were older than 60 years. The mean age was 52.1 years. Figure 12 depicts the distribution.

Quantitative Study Demographic: Age

Age	Frequency	Percent	Cumulative Percent
> 40	15	12%	12%
41-50	35	27%	38%
51-60	56	43%	82%
< 61	24	18%	100%
Total	130	100%	

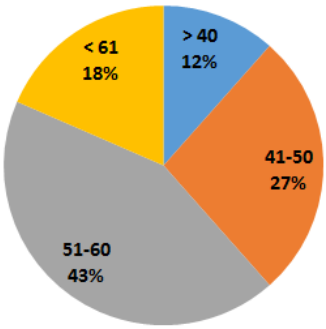


Figure 12: Quantitative Study Demographic for Age

Years of Business Experience: 3% had up to 10 years of business experience, 25% had between11-15, 35% has between16-25, 21% had between26-35 and 16% had more than 36 years of business experience. Average business experience was 23

years, which shows that respondents had good level of business experience (see Figure 13).

Quantitative Study Demographic: Years of Business Experience

Years	Frequency	Percent	Cumulative Percent
>10	4	3%	3%
11-15	32	25%	28%
16-25	46	35%	63%
26-35	27	21%	84%
> 36	21	16%	100%
Total	130	100%	

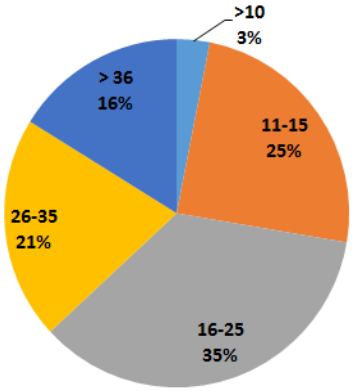


Figure 13: Quantitative Study Demographic for Years of Business Experience

Years in Current Position: 10% had one or two years of experience in their current position, while 81% of respondents held their current position between 3 and 15 years. Mean current position experience was 9 years, which shows that respondents have good understanding of their job and its associated processes.

Quantitative Study Demographic: Years in Current Position

Years	Frequency	Percent	Cumulative Percent
>2	13	10%	10%
3-6	26	20%	30%
7-10	46	35%	65%
11-15	34	26%	92%
> 15	11	8%	100%
Total	130	100%	

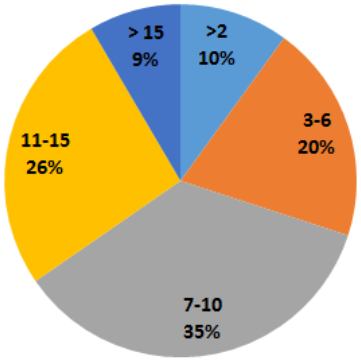


Figure 14: Quantitative Study Demographic for Years in Current Position

Geographical Dispersion: respondents were from 18 different countries. The detail of geographic dispersion is presented in Figure 15.

Role of Respondents: 61% percent of the respondents indicated that they are working in a senior management position, while 39% indicated they work as project managers or consultants. A total of 35% of respondents have professional project,

programme or portfolio management qualifications such as PMI or IMPA certifications (Figure 16).

Quantitative Study Demographic: Geographic Dispersion

Location	Frequency	Percent	Cumulative Percent
East Asia & Occenia	29	22%	22%
West Asia & Middle East	30	23%	45%
North America	23	18%	63%
Europe	30	23%	86%
South America	18	14%	100%
Total	130	100%	

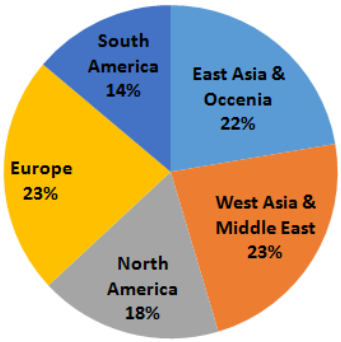


Figure 15: Quantitative Study Demographic for Geographic Dispersion

Quantitative Study Demographic: Position of Respondents

Location	Frequency	Percent	Cumulative Percent
CEO	2	2%	2%
Vice President & General Manager	17	13%	15%
Portfolio/ Programme Manager	51	39%	54%
PMO Manager	9	7%	61%
Project Director & Manager	27	21%	82%
Consultant	24	18%	100%
Total	130	100%	

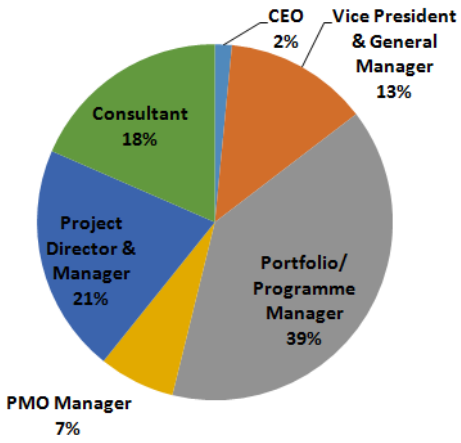


Figure 16: Quantitative Study Demographic for Position of Respondents

Industry/Sector: Demographic dispersion by industry shows the energy sector is dominated by industry in this research; it is followed by material and then utilities and construction sectors. Other sectors, including IT and finance, are below 5% of the responses. The energy sector includes oil & gas companies, chemical & petrochemical firms and organisations that provide engineering, procurement and construction services to energy operator/client companies. A total of 52% of the respondents in energy sector worked for client/operator originations, while 48% worked for contractor and/or consultant organisation (see Figure 17 for details).

The average project portfolio can be divided into five main categories including start of a new plant or facility or development of new product, expanding the existing operation of an organisation to a new market, managing existing portfolios, conducting organisational changes and others. The result is presented in Figure 18.

Quantitative Study Demographic: Industry

Sector/Industry	Frequency	Percent	Cumulative Percent
Energy	78	60%	60%
Material	23	18%	78%
Utilities	12	9%	87%
Construction	12	9%	96%
Other	5	4%	100%
Total	130	100%	

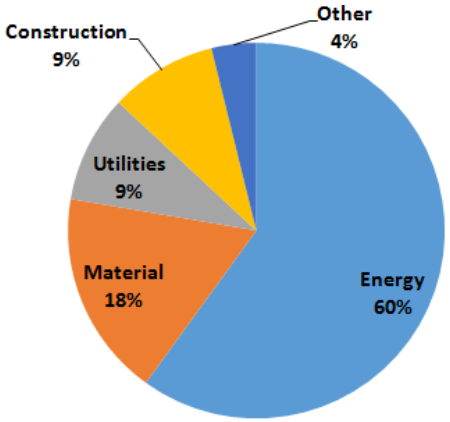


Figure 17: Quantitative Study Demographic for Industry

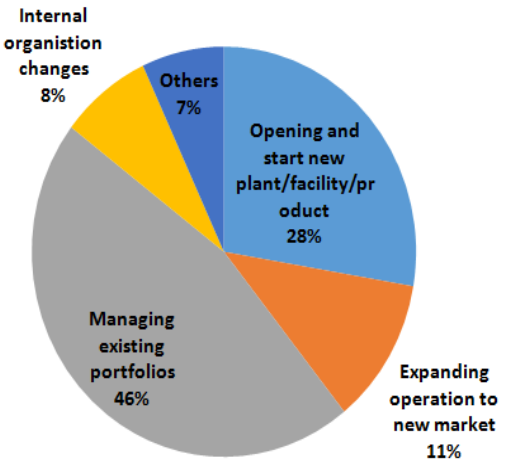
Figure 18: Quantitative Study Demographic for Portfolio Main Objective

4.2 Descriptive Statistics of Variables

In this section, descriptive statistics for dependents, independents and moderating variables are presented. Each associated question (presented in Section 3.1.2) is rated from 1 to 5 based on the 5-point Likert Scale by respondent. The range, mean, standard variations and variance for each question are presented in the following tables. The provided data are used for performing statistical analysis in

Quantitative Study Demographic: Portfolio Main Objective

Portfolio Main Objective	Frequency	Percent	Cumulative Percent
Opening and start new plant/facility/product	36	28%	28%
Expanding operation to new market	15	12%	39%
Managing existing portfolios	60	46%	85%
Internal organistion changes	10	8%	93%
Others	9	7%	100%
Total	130	100%	



order to test the research hypotheses. To increase reliability of questions, the mean of 3.5 is considered neutral.

Table 4 shows the statistical information for the premise control variable and each of the questions asked for that variable. All the means for the premise control variable are above the neutral measure, which shows participants agreed with the statements provided to them as mean of measurement indicator.

Variables	N	Min	Max	Range	Mean	STD	Variance
PRC-A	130	1	5	4	3.515	0.9583	0.9184
PRC-B	130	2	5	4	3.585	1.1329	1.2835
PRC-C	130	1	5	3	3.508	0.8376	0.7015
PRC-D	130	1	5	4	3.515	1.0509	1.1044
Premise Control	**130**	**1.75**	**5**	**3.25**	**3.531**	**0.7536**	**0.5678**

Table 4: Premise Control Variable in Questions

The statistical information for implementation control and each corresponding question are presented in Table 5. All the means for implementation control variables except IMC-C (associated with development of strategic thrust) are above the 3.5.

Variables	N	Min.	Max.	Range	Mean	STD	Variance
IMC-A	130	1	5	4	3.592	1.0169	1.034
IMC-B	130	2	5	4	3.608	0.9604	0.922
IMC-C	130	1	5	4	3.488	1.0101	1.020
IMC-D	130	2	5	4	3.815	1.0696	1.144
Implementation Control	**130**	**1.5**	**5**	**3.5**	**3.563**	**0.9449**	**0.8927**

Table 5: Implementation Control Variable in Questions

The means for strategic surveillance control and each of the associated questions are given in Table 6. The means that exceed the average level show agreement with provided statements.

Variables	N	Min.	Max.	Range	Mean	STD	Variance
SSC-A	130	1	5	4	3.531	0.7795	0.608
SSC-B	130	2	5	3	3.592	0.7439	0.553
SSC-C	130	2	5	3	3.523	0.7797	0.608
Strategic Surveillance	**130**	**1.67**	**5**	**3.33**	**3.549**	**0.6055**	**0.3667**

Table 6: Strategic Surveillance Control Variable in Questions

The means for special alert control and each of the associated questions are given in Table 7. The means that exceed the neutral measure, show agreement with provided statements.

Variables	N	Min.	Max.	Range	Mean	STD	Variance
SAC-A	130	1	5	4	3.532	0.7987	0.638
SAC-B	130	1	5	4	3.511	0.8324	0.693
Special Alert Control	**130**	**1**	**5**	**4**	**3.521**	**0.6613**	**0.4373**

Table 7: Special Alert Control Variable in Questions

The means for overall business performance and each of the corresponding questions are given in Table 8. As it can be seen, all means are above or near 3.5, which shows respondents agreed with statements given.

Variables	N	Min.	Max.	Range	Mean	STD	Variance
POS-A	130	2	5	4	3.538	0.5861	0.3435
POS-B	130	2	5	4	3.508	0.7287	0.5309
POS-C	130	1	5	3	3.646	0.7138	0.5095
POS-D	130	1	5	4	3.485	0.7285	0.5308
Overall Business Success	**130**	**1.5**	**5**	**3.5**	**3.552**	**0.6262**	**0.3921**

Table 8: Overall Business Success in Questions

The means for average project success within a portfolio and each of the associated questions are given in Table 9. As it can be seen, all means for corresponding questions are above neutral or approaching 3.5, showing agreement with provided statements.

Variables	N	Min.	Max.	Range	Mean	STD	Variance
PAS-A	130	2	5	4	3.662	0.7213	0.5202
PAS-B	130	2	5	4	3.592	0.7645	0.5844
PAS-C	130	2	5	3	3.631	0.9077	0.8239
PAS-D	130	2	5	4	3.484	0.8194	0.6715
Overage Project Success	**130**	**2.5**	**5**	**2.5**	**3.592**	**0.7378**	**0.5443**

Table 9: Average Project Success in Questions

The means for portfolio balance and each of the associated questions are given in Table 10. It can be seen that means for all questions are above 3.5, which shows agreement with the provided statements.

Variables	N	Max.	Min.	Range	Mean	STD	Variance
PBA-A	130	2	5	4	3.515	0.7996	0.6393
PBA-B	130	2	5	4	3.525	0.8730	0.7621
PBA-C	130	2	5	3	3.546	0.9492	0.9010
PBA-D	130	1	5	4	3.500	0.7900	0.6240
Portfolio Balance	**130**	**1.75**	**5**	**3.25**	**3.525**	**0.7769**	**0.6035**

Table 10: Portfolio Balance in Questions

The means for portfolio strategic fit and each of the associated questions are given in Table 11. It can be seen that means for all questions are above 3.5, which shows agreement with the provided statements.

Variables	N	Min.	Max.	Range	Mean	STD	Variance
PSF-A	130	2	5	4	3.585	0.6680	0.4463
PSF-B	130	2	5	4	3.546	0.7056	0.4979
PSF-C	130	1	5	3	3.577	0.6690	0.4475
Portfolio Strategic Fit	**130**	**1.67**	**5**	**3.33**	**3.569**	**0.5802**	**0.3367**

Table 11: Portfolio Strategic Fit in Questions

The means for portfolio interdependency and portfolio dynamic and each of the associated questions are given in Table 12 and Table 13 respectively. It can be seen

that means for all questions are approaching neutral means or above 3.5, which shows agreement with the provided statements.

Variables	N	Min.	Max.	Range	Mean	STD	Variance
PCO-A	130	1	5	4	3.543	0.782	0.612
PCO-B	130	1	5	4	3.498	0.829	0.687
PCO-C	130	1	5	4	3.484	0.811	0.658
PCO-D	130	1	5	4	3.512	0.923	0.852
PCO-E	130	1	5	3.8	3.498	0.813	0.661
Portfolio Interdependency	**130**	**2**	**5**	**3**	**3.507**	**0.911**	**0.830**

Table 12: Portfolio Interdependency in Questions

Variables	N	Min.	Max.	Range	Mean	STD	Variance
PDY-A	130	2	5	3	3.522	0.763	0.582
PDY-B	130	2	5	3	3.501	0.801	0.642
PDY-C	130	2	5	3	3.512	0.589	0.347
PDY-D	130	2	4	2	3.482	0.783	0.613
Portfolio Dynamic	**130**	**2**	**4.6**	**2.6**	**3.504**	**0.559**	**0.312**

Table 13: Portfolio Dynamic in Questions

The means for strategic control and the portfolio complexity and portfolio dynamic as the moderating effects also are presented in Table 14 and Table 15 respectively.

Variables	N	Min.	Max.	Range	Mean	STD	Variance
Portfolio Complexity	130	2	5	3	3.521	0.789	0.623
Strategic Control	130	2	5	3	3.541	0.589	0.347
Strategic Control@ Complexity	**130**	**4.12**	**25**	**20.88**	**12.563**	**3.721**	**13.847**

Table 14: Strategic Control and Moderating Effect of Portfolio Complexity

Variables	N	Min.	Max.	Range	Mean	STD	Variance
Portfolio Dynamic	130	2	4.6	2.6	3.504	0.559	0.312
Strategic Control	130	2	5	3	3.541	0.589	0.347
Strategic Control@ Dynamic	**130**	**3.03**	**21.02**	**17.99**	**12.408**	**2.766**	**7.651**

Table 15: Strategic Control and Moderating Effect of Portfolio Dynamic

RELIABILITY OF SCALES

The reliability of the variables is measured by performing a Cronbach Alpha test. The results are presented in Table 31 for variables and indicate a reliable scale for all variables. Cronbach alpha values of 0.70 and higher are considered to be reliable (Kline 1999). Therefore it can be seen, that all research variables are reliable.

Table 16: Cronbach alpha for Research Variables

Variable	Cronbach's Alpha
Strategic Premise Control	0.842
Strategic Implementation Control	0.883
Strategic Surveillance Control	0.786
Special Alert Control	0.758
Portfolio Complexity	0.908
Portfolio Dynamic	0.917
Overall Business Success	0.851
Average Project Success	0.856
Portfolio Balance	0.825
Portfolio Strategic Fit	0.802

4.3 Hypotheses Test Result

The following section presents the results of the statistical analyses that were performed for the research questions and their corresponding hypotheses.

4.3.1 The Statistical Methods

The following statistical methods are used in order to test the hypotheses:

Linear regression analysis was used to test hypotheses 1, 2, 3, 5, 6 and 7. The results are presented by the following values:

- The beta or r value represents standardised regression coefficients and it is a measure of how strongly each independent variable influences the dependent variable. The positive value of r represents the positive relationship between independent variable and dependent variable. The higher the beta value, the greater the impact of the independent variable on the dependent variable (Chatterjee and Simonoff 2013, p. 19).
- The p-value for each set of data tests the null hypothesis that the coefficient is equal to zero, therefore it has the probability of providing a better result than what was observed when the null hypothesis is true p value. The beta value is considered statistically significant if the p value is less than 0.05 (Moyé 2006, p. 7).
- R^2 indicates the proportion of the variance in the dependent variable that is predictable from the independent variable (Buse 1973, p. 107). R^2 of 1 indicates that the regression line perfectly fits the data. Adjusted R^2 adjusts for the number of terms in a model and shows if the research model use a series of new data, this can be interpreted as the amount of variability in the new data. In other words R^2 is a measure of fit, and adjusted R^2 is a measure of suitability of a new data set (Anderson-Sprecher 1994, p. 113).
- The F value and its probability test the overall significance of the regression analysis. The p value of F is the probability that the null hypothesis for the full model is true. The F value is considered significant if the p value is less than 0.05.

Student's t-test method was used to test hypotheses 4 and 8 in order to find significant differences between the means of each of the portfolio performance variables for any two distinct groups. The t value measures the size of difference relative to the variation of a set of data. The greater the magnitude of t value, the greater the evidence against the null hypothesis that there is no significant difference (Gregersen 2011, p. 320). The difference between the means of the two groups is considered statistically significant if the p value is less than 0.05.

Analysis of variance (One-way ANOVA) in combination with the Scheffe procedure was performed to test hypothesis 8 in order to analyse the difference in the means of portfolio management performance for four distinct groups of organisational governance type; this F-statistic in ANOVA is a ratio of the variability between groups compared to the variability within the groups (Maxwell and Delaney 2004, p. 120). While ANOVA is used to measure the differences among groups, the Scheffe test is used to compare differences between all pairs of means. The F value for ANOVA and t value for the Scheffe test are considered significant if the p value is less than 0.05.

4.3.2 Hypotheses Testing

Research question 1: Is there any relationship between the use of strategic control processes in portfolio and portfolio complexity?

Hypothesis 1: Use of strategic control processes in a portfolio is directly related to portfolio complexity.

In this research, portfolio complexity is measured by portfolio size and portfolio interdependency. Table 16 presents the result of regression analysis for each of the strategic control types and portfolio complexity.

Table 17:Result of Regression Analysis for Strategic Control Types and Portfolio Complexity

Variable	Premise Control	Implementation Control	Strategic Surveillance	Special Alert Control
Portfolio Complexity	0.571*	0.709*	0.490*	0.433*
R^2	0.326	0.502	0.240	0.188
Adjusted R^2	0.321	0.498	0.234	0.181
F Value	61.99**	129.18**	40.36**	29.55**

*p<0.001 **p<0.0005

The results in Table 16 show a positive relationship between:

- Portfolio complexity and use of premise control in portfolio at 0.001significance level, where $R^2 = 0.326$ and Beta= 0.571.

- Portfolio complexity and use of implementation control in portfolio at 0.001significance level, where $R^2 = 0.502$ and Beta= 0.709
- Portfolio complexity and use of strategic surveillance control in portfolio at 0.001significance level, where $R^2 = 0.240$ and Beta= 0.490
- Portfolio complexity and use of special alert control in portfolio at 0.001significance level, where $R^2 = 0.188$ and Beta= 0.433

The results show when the degree of complexity increases in a portfolio, the deployment of strategic control processes increase accordingly. Therefore hypothesis 1 is supported. The strongest relationship is between implementation control and portfolio complexity, while the weakest relationship is between special alert control and portfolio complexity.

Research question 2: Is there any relationship between the use of strategic control processes in project portfolio and portfolio dynamics?

Hypothesis 2: Use of strategic control processes in portfolio is directly related to portfolio dynamics.

Table 17 presents the result of regression analysis for each of the strategic control types and portfolio dynamics.

Table 18: Result of Regression Analysis for Strategic Control Types and Portfolio Dynamic

Variable	Premise Control	Implementation Control	Strategic Surveillance	Special Alert Control
Portfolio Dynamic	0.491*	0.638*	0.463*	0.421*
R^2	0.241	0.407	0.214	0.177
Adjusted R^2	0.235	0.402	0.208	0.171
F Value	40.61**	87.81**	34.88**	27.54**

*p<0.001 **p<0.0005

The results in table 17 show a positive relationship between:

- Portfolio dynamic and use of remise control in portfolio at 0.001signifiance level, where $R^2 = 0.241$ and Beta= 0.491.

- Portfolio dynamic and use of implementation control in portfolio at 0.001signifiance level, where $R^2 = 0.407$ and Beta= 0.638.
- Portfolio dynamic and use of strategic surveillance control in portfolio complexity at 0.001signifiance level, where $R^2 = 0.214$ and Beta= 0.463.
- Portfolio dynamic and use of special alert control in portfolio at 0.001signifiance level, where $R^2 = 0.177$ and Beta= 0.421.

The results shows organisations have a greater tendency to use strategic control processes in their portfolio in a more dynamic portfolio. Therefore, hypothesis 2 is supported. The strongest relationship is between implementation control and the portfolio dynamic while the weakest relationship is between special alert control and the portfolio dynamic.

Research question 3: Is there any relationship between use of strategic control processes while implementing portfolio objectives and project portfolio management performance?

Hypothesis 3: There is a positive relationship between use of strategic control processes in a portfolio while implementing portfolio objectives and project portfolio management performance.

In this research, portfolio performance is measured using four factors including average project success, portfolio balance, strategic fit, and overall business success.

Table 18 presents the result of regression analysis for premise control and four indicators of portfolio performance.

The results show a positive relationship between:

- Use of premise control in portfolio and overall business success at significance level $p<0.001$, where $R^2 = 0.438$ and Beta= 0.661.
- Use of premise control in portfolio and average project success at significance level $p<0.001$, where $R^2 = 0.213$ and Beta= 0.462
- Use of premise control in portfolio and portfolio balance at significance level $p<0.001$, where $R^2 = 0.311$ and Beta= 0.558

- Use of premise control in portfolio and portfolio strategic fit at significance level $p<0.001$, where $R^2 = 0.343$ and Beta= 0.590

The results show the strongest relationship between the deployment of premise control in portfolio and overall business success and the weakest relationship between use of premise control and average project success.

Table 19: Result of Regression Analysis for the Use of Premise Control and Portfolio Performance Indicators

Variable	Overall Business Success	Average Project Success	Portfolio Balance	Portfolio Strategic Fit
Premise Control	0.661*	0.462*	0.558*	0.590*
R^2	0.438	0.213	0.311	0.348
Adjusted R^2	0.433	0.207	0.306	0.343
F Value	99.57**	34.65**	57.82**	68.37**

*p<0.001 **p<0.0005

Table 19 presents the result of regression analysis for implementation control and four factors of portfolio performance.

Table 20: Result of Regression Analysis for the Use of Implementation Control and Portfolio Performance Indicators

Variable	Overall Business Success	Average Project Success	Portfolio Balance	Portfolio Strategic Fit
Implementation Control	0.692*	0.557*	0.691*	0.652*
R^2	0.406	0.310	0.478	0.425
Adjusted R^2	0.401	0.305	0.474	0.420
F Value	87.37**	57.48**	117.15**	94.51**

*p<0.001 **p<0.0005

The results in table 19 show a positive relationship between:

- Use of implementation control in portfolio and overall business success at $p<0.001$, where $R^2 = 0.406$ and Beta= 0.637.
- Use of implementation control in portfolio and average project success at $p<0.001$, where $R^2 = 0.310$ and Beta= 0.557
- Use of implementation control in portfolio and portfolio balance at $p<0.001$, where $R^2 = 0.478$ and Beta= 0.691
- Use of implementation control in portfolio and portfolio strategic fit at $p<0.001$, where $R^2 = 0.425$ and Beta= 0.652

The results show the deployment of implementation control has a strongest impact on portfolio balance and portfolio strategic fit.

Table 20 presents the result of regression analysis for strategic surveillance control and four factors of portfolio performance.

Table 21: Result of Regression Analysis for the Use of Strategic Surveillance Control and Portfolio Performance Indicators

Variable	Overall Business Success	Average Project Success	Portfolio Balance	Portfolio Strategic Fit
Strategic Surveillance Control	0.503*	0.340*	0.380*	0.413*
R^2	0.247	0.115	0.145	0.171
Adjusted R^2	0.247	0.108	0.138	0.138
F Value	43.35**	16.68**	21.66**	26.38**

*p<0.001 **p<0.0005

The results in table 20 show a positive and significant relationship between:

- Use of strategic surveillance control in portfolio and overall business success at $p<0.001$, where $R^2 = 0.247$ and Beta= 0.503.
- Use of strategic surveillance control in portfolio and average project success at $p<0.001$, where $R^2 = 0.115$ and Beta= 0.340
- Use of strategic surveillance control in portfolio and portfolio balance at $p<0.001$, where $R^2 = 0.145$ and Beta= 0.380

- Use of strategic surveillance control in portfolio and portfolio strategic fit at $p<0.001$, where $R^2 = 0.171$ and Beta= 0.413.

The results show the strongest relationship between the deployment of strategic surveillance control in portfolio and overall business success and the weakest relationship between use of strategic surveillance control and average project success.

Table 21 presents the result of regression analysis for special alert control and four factors of portfolio performance. The results show there is a positive and significant between:

- Use of special alert control in portfolio and overall business success at $p<0.001$, where $R^2 = 0.141$ and Beta= 0.375.
- Use of special alert control in portfolio and average project success at $p<0.001$, where $R^2 = 0.08$ and Beta= 0.283
- Use of special alert control in portfolio and portfolio balance at $p<0.001$, where $R^2 = 0.123$ and Beta= 0.350
- Use of special alert control in portfolio and portfolio strategic fit at $p<0.001$, where $R^2 = 0.111$ and Beta= 0.333.

Table 22: Result of Regression Analysis for the Use of Special Alert Control and Portfolio Performance Indicators

Variable	Overall Business Success	Average Project Success	Portfolio Balance	Portfolio Strategic Fit
Special Alert Control	0.375*	0.283*	0.350*	0.333*
R^2	0.141	0.080	0.123	0.111
Adjusted R^2	0.134	0.073	0.116	0.104
F Value	20.97**	11.12**	17.90**	16.00**

*p<0.001 **p<0.0005

The results presented in Table 18 to Table 21 show there are positive and significant relationships between strategic control types and portfolio performance indicators. Therefore, hypothesis 3 is supported. The results shows the deployment of implementation control in a portfolio have stronger impact on portfolio performance

than other types of strategic control. It is followed by premise control, strategic surveillance control and special alert control respectively. The strongest relationship is between implementation control and portfolio balance and the weakest relationship is between special alert control and average project success.

Research question 4: Is there any difference between the performance of portfolios in which a portfolio manager deploys strategic control in the portfolio and the performance of portfolios in which a portfolio manager does not use strategic control?

Hypothesis 4: Portfolios in which a portfolio manager deploys a strategic control system have better performance than portfolios in which a portfolio manager deploys only a traditional control system

Each of the 130 cases could be classified into two categories: (1) Use of a strategic control system in the portfolio and (2) No use of a strategic control system in the portfolio.

The hypothesis was tested using the Student's t-test for each of the performance factors. Table 22 present the results of the Student's t-test for difference in the means of performance between organisations that use strategic control in their portfolios and organisations that do not use strategic control in their portfolios. The results show that all four dependent variables of performance of the first group are significantly higher than that of the second group. Therefore, hypothesis 4 is supported.

Table 23: Result of Student's t-tests for Differences in Means of Performance between Organisations that Use Strategic Control in Their Portfolios and Organisations that Do Not Use Strategic Control in Their Portfolios

Performance Measure: Overall Business Success					
Group	N	Mean	SD	t	P value
Use of Strategic Control	72	3.915	0.288	7.867	<0.0005
Not Use of Strategic Control	58	2.989	0.135		
Performance Measure: Average Project Success					
Group	N	Mean	SD	t	P value
Use of Strategic Control	72	3.858	0.667	6.161	<0.0005
Not Use of Strategic Control	58	3.204	0.724		
Performance Measure: Portfolio Balance					
Group	N	Mean	SD	t	P value
Use of Strategic Control	72	3.948	0.665	7.634	<0.0005
Not Use of Strategic Control	58	3.011	0.563		
Performance Measure: Portfolio Strategic Fit					
Group	N	Mean	SD	t	P value
Use of Strategic Control	72	4.125	0.357	12.332	<0.0005
No Use of Strategic Control	58	3.146	0.543		

Research question 5: What is the moderating effect of portfolio size on deployment of strategic control in a portfolio and project portfolio performance?

Hypothesis 5: The portfolio size positively moderates the relationship between use of strategic control in a portfolio and portfolio management performance.

Table 23 presents the result of regression analysis for project portfolio performance and the moderating effect of portfolio size on each of the strategic control types.

The results show there are positive and significant relationships between strategic control types (premise control, implementation control, strategic surveillance and special alert control), portfolio size and portfolio performance. Therefore, hypothesis 5 is supported at $p<0.001$.

Table 24: Result of Regression Analysis for Portfolio Performance and the Moderating Effect of Portfolio Size on Strategic Control Types

Variable	PRC * PSI	IMC*PSI	SSC*PSI	SAC*PSI
Portfolio Performance	0.600*	0.697*	0.528*	0.478*
R^2	0.359	0.486	0.279	0.229
Adjusted R^2	0.354	0.482	0.273	0.273
F Value	71.84**	121.00**	49.55**	37.92**

*p<0.001 **p<0.0005

PRC: Premise Control; IMC: Implementation Control; SSC: Strategic Surveillance Control; SAC: Special Alert Control; PSI: Portfolio Size

Research question 6: What is the moderating effect of portfolio interdependency on deployment of strategic control in portfolio and project portfolio performance?

Hypothesis 6: The portfolio interdependency positively moderates the relationship between use of strategic control in portfolio and portfolio management performance.

Table 24 presents the result of regression analysis for project portfolio performance and the moderating effect of portfolio interdependency on each of the strategic control types.

The results show there are positive and significant relationships between strategic control types (premise control, implementation control, strategic surveillance and special alert control), portfolio interdependency and portfolio performance. Therefore, hypothesis 6 is supported at $p<0.001$.

Table 25: Result of Regression Analysis for Portfolio Performance and the Moderating Effect of Portfolio Interdependency on Strategic Control Types

Variable	PRC * PIN	IMC*PIN	SSC*PIN	SAC*PIN
Portfolio Performance	0.532*	0.720**	0.485**	0.456**
R^2	0.283	0.519	0.236	0.208
Adjusted R^2	0.277	0.515	0.230	0.230
F Value	50.44**	138.04**	39.46**	33.54**

*p<0.001 **p<0.0005

PRC: Premise Control; IMC: Implementation Control; SSC: Strategic Surveillance Control; SAC: Special Alert Control; PIN: Portfolio Interdependency

Research question 7: What is the moderating effect of the portfolio dynamic on deployment of strategic control in portfolio and project portfolio performance?

Hypothesis 7: The portfolio dynamic positively moderates the relationship between use of strategic control and portfolio management performance.

Table 25 presents the result of regression analysis for project portfolio performance and the moderating effect of the portfolio dynamic on each of the strategic control types. The results show there are positive and significant relationships between strategic control types, portfolio dynamic and portfolio performance. Therefore hypothesis 7 is supported at p<0.001.

Table 26: Result of Regression Analysis for Portfolio Performance and the Moderating Effect of Portfolio Dynamic on Strategic Control Types

Variable	PRC * PDY	IMC*PDY	SSC*PDY	SAC*PDY
Portfolio Performance	0.503**	0.664**	0.414**	0.358**
R^2	0.253	0.441	0.172	0.128
Adjusted R^2	0.247	0.436	0.165	0.121
F Value	43.32**	100.92**	26.53**	18.76**

*p<0.001 **p<0.0005

Research question 8: What is the moderating effect of the governance type of an organisation on deployment of strategic control in portfolio and project portfolio performance?

Hypothesis 8: The governance type of the organisation positively moderates the relationship between use of strategic control and portfolio management performance.

To test hypothesis 8, one-way ANOVA in combination with the Scheffe procedure, was performed in order to analyse the difference in the means of performance for the four following groups for each of the strategic control types.

- Multi-project organisation: Projects in the organisation do not share resources and do not have related objectives.
- Programme driven organisation: Projects in the organisation do not share resources, but have related objectives.
- Portfolio driven organisation: Projects in the organisation share resources, but do not necessarily have related objectives.
- Hybrid organisation: Projects in the organisation share resources and have related objectives.

Each of the cases in this study could be classified into one of the above categories. The following tables present the results of the ANOVAs and Scheffe test for each of the four performance factors and strategic control types.

Table 27: Result of One-way ANOVA for Use of Strategic Premise Control in Portfolio as Related to Organisational Governance Type

Source:	Degree of Freedom	Sum of Squares	Mean Squares	F Ratio	p-value
Between Groups	3	34.883	11.628	24.819	<0.0005
Within Groups	126	59.032	0.469		
TOTAL	129	93.916			

Group:	N	Mean	Variance
Multi-Project Organisation	32	2.627	0.492
Mainly Program Management Organisation	21	3.095	0.447
Mainly Portfolio Management Organisation	33	3.495	0.283
Hybrid Organisation	44	3.956	0.599

Scheffe Results

Group Pairs	Scheffe T-Statistics	Scheffe p-value	Scheffe Inference
Multi-Project vs Mainly Program Management	2.438		Insignificant
Multi-Project vs Mainly Portfolio Management	5.117	<0.01	Significant
Multi-Project vs Hybrid	8.358	<0.01	Significant
Mainly Program vs Mainly Portfolio	2.915	<0.05	Insignificant
Mainly Program Management vs Hybrid	4.740	<0.01	Significant
Mainly Portfolio Management vs Hybrid	2.920	<0.05	Significant

The results of the ANOVA for premise control and each of the governance type show there is a significant difference between groups (Table 26). The Scheffe test (Table 26) indicates that hybrid organisations' performances are significantly higher than other types of governance. The Scheffe test also reveals that portfolio-driven organisations have better performance than multi-project and programme management organisations. There is no significant difference between the performance of portfolio-driven organisations and programme-driven organisations while applying premise control in portfolios.

Table 28: Result of One-way ANOVA for Use of Strategic Implementation Control in Portfolio as Related to Organisational Governance Type

Source:	Degree of Freedom	Sum of Squares	Mean Squares	F Ratio	p-value
Between Groups	3	38.649	12.883	30.087	<0.0005
Within Groups	126	53.953	0.428		
TOTAL	129	92.602			

Group:	N	Mean	Variance
Multi-Project Organisation	32	2.705	0.473
Mainly Program Management Organisation	21	3.067	0.387
Mainly Portfolio Management Organisation	33	3.617	0.331
Hybrid Organisation	44	4.069	0.487

Scheffe Results

Group Pairs	Scheffe T-Statistics	Scheffe p-value	Scheffe Inference
Multi-Project vs Mainly Program Management	1.969		Insignificant
Multi-Project vs Mainly Portfolio Management	5.617	<0.01	Significant
Multi-Project vs Hybrid	8.977	<0.01	Significant
Mainly Program vs Mainly Portfolio	3.011	<0.05	Significant
Mainly Program Management vs Hybrid	5.777	<0.01	Significant
Mainly Portfolio Management vs Hybrid	3.004	<0.05	Significant

The results of the ANOVA for implementation control and each of the governance types (Table 27) shows there is a significant difference between groups. The Scheffe test indicates that hybrid organisations' performances are significantly higher than other types of governance. The Scheffe test (Table 27) also reveals that portfolio-driven organisations have better performance than multi-project and program-driven organisations. There is no significance difference between the performance of multi-project organisations and program-driven organisations while using implementation control in portfolios.

Table 29: Result of One-way ANOVA for Use of Strategic Surveillance Control in Portfolio as Related to Organisational Governance Type

Source:	Degree of Freedom	Sum of Squares	Mean Squares	F Ratio	p-value
Between Groups	3	33.598	11.199	23.813	<0.0005
Within Groups	126	59.258	0.470		
TOTAL	129	92.856			

Group:	N	Mean	Variance
Multi-Project Organisation	32	2.673	0.498
Mainly Program Management Organisation	21	3.000	0.457
Mainly Portfolio Management Organisation	33	3.435	0.278
Hybrid Organisation	44	3.956	0.599

Scheffe Results

Group Pairs	Scheffe T-Statistics	Scheffe p-value	Scheffe Inference
Multi-Project vs Mainly Program Management	1.696		Insignificant
Multi-Project vs Mainly Portfolio Management	4.475	<0.01	Significant
Multi-Project vs Hybrid	8.048	<0.01	Significant
Mainly Program vs Mainly Portfolio	2.271		Insignificant
Mainly Program Management vs Hybrid	5.254	<0.01	Significant
Mainly Portfolio Management vs Hybrid	3.298	<0.05	Significant

The results of the ANOVA for strategic surveillance control and each of the governance types (Table 28) shows there is a significant difference between groups. The Scheffe test indicates that a hybrid organisation's performances are significantly higher than other types of governance. The Scheffe test (Table 28) also reveals that portfolio-driven organisations have better performance than multi-project. There is no significant difference between the performance of multi-project organisations and program-driven organisations. There is no significant difference between the performance of portfolio-driven organisations and programme-driven organisations while applying strategic surveillance control in portfolios.

Table 30: Result of One-way ANOVA for Use of Strategic Special Alert Control in Portfolio as Related to Organisational Governance Type

Source:	Degree of Freedom	Sum of Squares	Mean Squares	F Ratio	p-value
Between Groups	3	16.154	5.385	13.876	<0.0005
Within Groups	126	48.893	0.388		
TOTAL	129	65.047			

Group:	N	Mean	Variance
Multi-Project Organisation	32	2.859	0.403
Mainly Program Management Organisation	21	3.000	0.457
Mainly Portfolio Management Organisation	33	3.282	0.176
Hybrid Organisation	44	3.728	0.503

Scheffe Results

Group Pairs	Scheffe T-Statistics	Scheffe p-value	Scheffe Inference
Multi-Project vs Mainly Program Management	0.804		Insignificant
Multi-Project vs Mainly Portfolio Management	2.733		Insignificant
Multi-Project vs Hybrid	6.005	<0.01	Significant
Mainly Program vs Mainly Portfolio	1.621		Insignificant
Mainly Program Management vs Hybrid	4.409	<0.01	Significant
Mainly Portfolio Management vs Hybrid	3.113	<0.05	Significant

The results of the ANOVA for special alert control and each of the governance types (Table 29) show there is a significant difference between groups. The Scheffe test (Table 29) indicates that a hybrid organisation's performances are significantly higher than other types of governance. There is no significant difference between the performance of multi-driven, portfolio-driven and programme-driven organisations while applying special alert controls in portfolios.

The Student's t-tests were performed in order to analyse the differences in means of each of the performance indicators between hybrid organisations and other type of governance organisations. The results are presented in Table 30.

Table 31: Result of Student's t-tests for Differences in Means of Use of Strategic Control between "Hybrid Organisations" and other Type of Governance

Performance Measure: Overall Business Success					
Group	N	Mean	SD	t	P value
Hybrid Organisations	44	4.101	0.359	6.255	<0.0005
Other Type of Governance	86	3.074	0.287		
Performance Measure: Average Project Success					
Group	N	Mean	SD	t	P value
Hybrid Organisations	44	3.728	0.237	7.011	<0.0005
Other Type of Governance	86	3.143	0.302		
Performance Measure: Portfolio Balance					
Group	N	Mean	SD	t	P value
Hybrid Organisations	44	3.998	0.359	6.444	<0.0005
Other Type of Governance	86	3.055	0.254		
Performance Measure: Use of Strategic Control					
Group	N	Mean	SD	t	P value
Hybrid Organisations	44	4.063	0.253	5.391	<0.0005
Other Type of Governance	86	3.056	0.127		

The results show that all four dependent variables of performance of the hybrid organisations are significantly higher than those of the other type of governance.

In accordance with the results of ANOVA analysis and Student's t-test, hypothesis 8 is supported.

4.4 Summary

This chapter presented findings of the study. All eight hypotheses were supported.

The first section presented the survey demographic results for age, business experiences, geographic locations, position of the respondents and the industry for which they work. The second section presented descriptive statistics of variables followed by the results of hypothesis testing. The findings are summarised below:

1. Portfolio complexity, which is measured by portfolio size and portfolio interdependency, is directly related to the use of strategic control processes in portfolio. The regression analysis showed there is a positive and significant relationship between each of the strategic control types and portfolio complexity.
2. Portfolio dynamic is directly related with the use of strategic control processes in a portfolio. The results of regression analysis showed a positive and significant relationship between each of the strategic control types and portfolio dynamic.
3. There is a positive relationship between use of a strategic control system while implementing portfolio objectives and portfolio management performance. The portfolio performance was measured by four different indicators including overall business success, average project success, portfolio balance and portfolio strategic fit. A series of regression analysis was performed to measure the relationship between each of the strategic control types and portfolio performance indicators. The results showed a positive relationship between dependent and independent variables.
4. Portfolios in which portfolio managers deploy strategic control systems have better performance than portfolios in which portfolio managers deploy only traditional control systems. The results of Student's t-test indicated all four

dependent variables of performance of an organisation that uses strategic control are significantly higher than the organisations that only use traditional control methods in their portfolios.

5. Portfolio size, portfolio interdependency and portfolio dynamic positively moderate the relationship between use of strategic control and portfolio management performance. The results of regression analysis revealed that the positive and significant relationship between use of strategic control in a portfolio as an independent variable and portfolio performance indicators as dependent variables is moderated by contextual factors of portfolio size, portfolio interdependency and portfolio dynamic.

6. The governance type of the organisation positively moderates the relationship between use of strategic control and portfolio management performance. A series of one-way ANOVA with the Scheffe test were performed in order to analyse the difference in the means of performance for each type of governance in the organisations. In addition, the results of Student's t-test indicated that the means of performance of hybrid organisations are significantly higher than the means of performance for portfolio, programme and multi-project driven organisations.

Chapter 5: Analysis

This chapter summarises the data analysis of research findings are presented in Chapter 4 by relating the results to the research objectives and literature. Section 5.1 briefly describes the theoretical concept of research variables. Section 5.2 discusses the findings regarding implementation of strategic control mechanisms in portfolio management by reviewing the results of analysis of the first two research hypotheses; Section 5.3 discusses the findings of the relationship between use of strategic control systems in portfolios and portfolio performance in different contextual factors. A summary of this section and the final research model are presented in section 5.4.

5.1 Retracing Research Variables

Organisations use portfolio management and portfolio planning techniques in order to aggregate business for strategic analysis or to guide diversity away from low-growth sectors (Bettis and Hall 1981, p. 29). This assists organisations to be able to respond to environmental constraints and to reduce uncertainties by selecting, prioritising and optimising portfolio components, and controlling interactions between components of portfolio. The concept that organisations design and execute different management styles to control their portfolio in order to increase portfolio performance and efficiency is one of the traditional ideas in portfolio management literature. This idea is based on the contingency theory, which suggests that every organisation needs to adjust its management style to its internal and external environment in order to operate effectively and efficiently in a competing environment (Sauser, Reilly et al. 2009, p. 666). In a complex portfolio environment where portfolio components share resources, have overall budget and experience high level of interdependency, organisations need to design and implement a robust control system in order to respond to environmental changes and portfolio complexity (Müller, Martinsuo et al. 2008, p. 32). This control system should be

aligned with organisational strategy to be able to control overall direction of portfolio strategy in light of internal and external changes. Strategic control is a means of evaluating organisation plans and activities and defining future actions to keep the organisation on track for its strategic movement; it consists of four types of control including premise control, implementation control, strategic surveillance and special alert control (Preble 1992, p. 395).

5.2 Implementation of Strategic Control in Portfolio

The first proposition of this research suggested that there is a positive relationship between portfolio complexity and the use of strategic management control in the portfolio. Portfolio complexity was defined by two factors: portfolio size and portfolio interdependency and each factor was measured on a five-point scale. Results of regression analysis as reported in Table 16 indicated a positive relation between portfolio complexity and premise control (Beta=0.571), implementation control (Beta=0.709), strategic surveillance control (Beta=0.490) and special alert control (Beta=0.433). All these relations are significant at $p<0.001$. Figures 19 to 22 show the relationship between the use of four types of strategic control in portfolio and portfolio complexity.

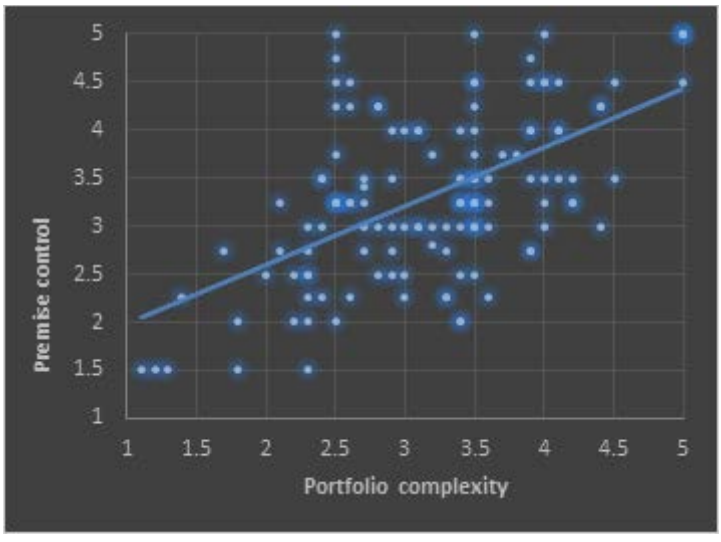


Figure 19: Relationship between Use of Premise Control in Portfolio and Portfolio Complexity

Use of Premise Control in Portfolio= 1.382+ 0.608 (Portfolio Complexity)

It is widely accepted by scholars that organisations need to understand the dependencies between portfolio components including projects and programmes and other operations to be able to select, prioritise and optimise portfolios in order to achieve the best outcomes (Rungi , Verma and Sinha 2002, Blau, Pekny et al. 2004). The portfolio management process provides some tools and techniques to manage interdependencies in the portfolio (Aritua, Smith et al. 2009, p. 75), however managing large-size, complex portfolios with high level of interdependency which is performed to deliver strategic objectives, creates some level of additional challenges that are not adequately addressed by existing portfolio management tools and techniques. Large portfolio execution brings more stakeholders, more internal and external environmental changes and accordingly, more threats and opportunities. Therefore, organisations need to implement a series of systematic actions and plans to strategically respond to the needs for control of high complex portfolios. This strategic control system in high complex portfolios is responsible for (1) monitoring environmental changes and their impact on portfolio assumptions to make sure all those assumptions are valid, (2) performing milestone reviews in order to capture early signals of strategic deviations and (3) scanning the internal and external portfolio environment for any potential threats that may have a high impact on the portfolio management system. The result of quantitative part of the research showed that when portfolio size and portfolio interdependency increase, organisations have a greater tendency to use strategic control mechanisms in order to manage project dependencies and respond to environmental changes in a timely manner.

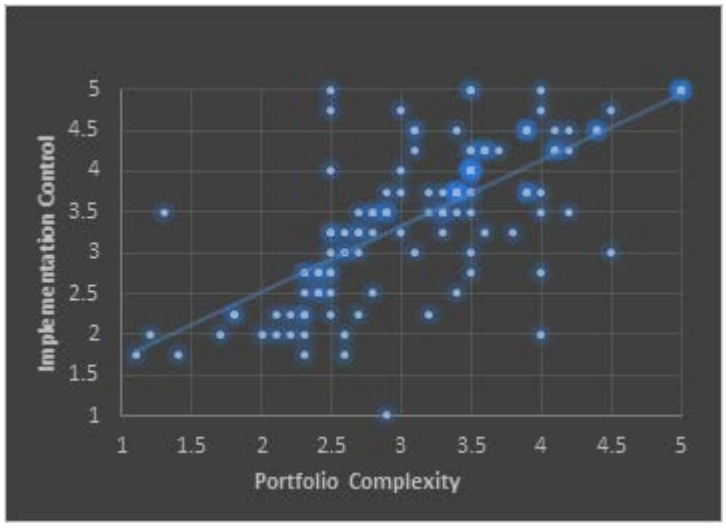


Figure 20: Relationship between Use of Implementation Control in Portfolio and Portfolio Complexity

Use of Implementation Control in Portfolio= 0.898+ 0.810 (Portfolio Complexity)

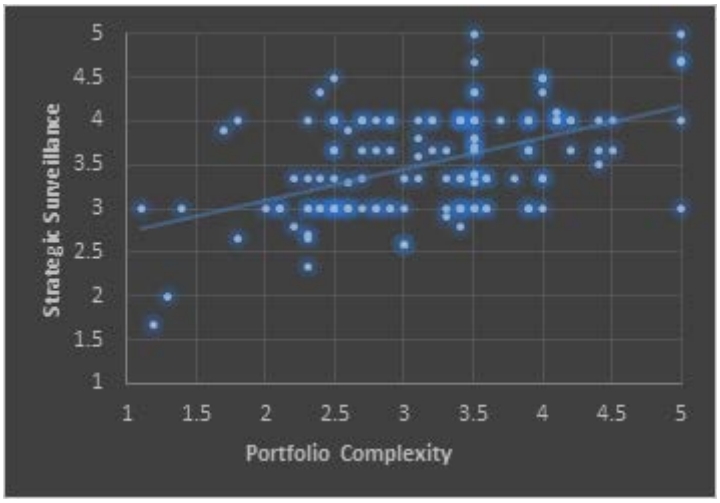


Figure 21: Relationship between Use of Strategic Surveillance in Portfolio and Portfolio Complexity

Use of Strategic Surveillance in Portfolio= 2.393+ 0.354 (Portfolio Complexity)

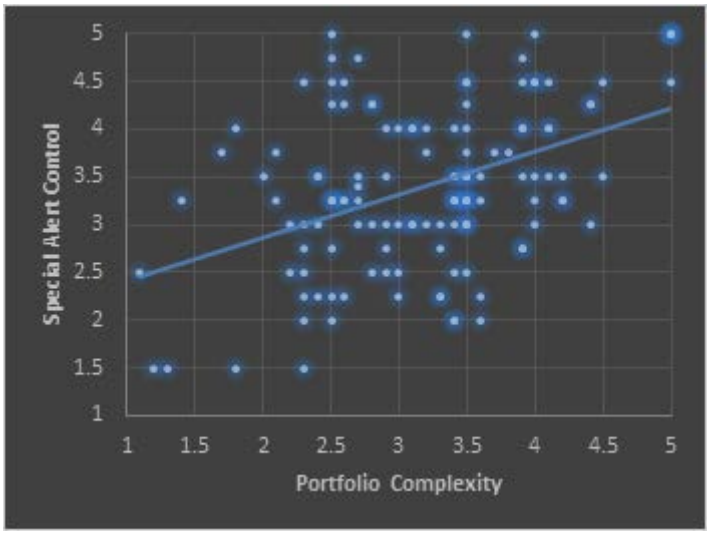


Figure 22: Relationship between Use of Special Alert Control in Portfolio and Portfolio Complexity

Use of Special Alert Control in Portfolio= 1.951+ 0.454 (Portfolio Complexity)

The results show the strongest relationship is between implementation control and portfolio complexity; it is followed by premise control and strategic surveillance, while the weakest relationship is between special alert control and portfolio complexity. This trend of relationship is logical as implementation control is responsible in assuring organisations that the overall portfolio directions are aligned with organisational strategy. In more complex portfolios the cumulative impact of environmental changes, stakeholder expectations and a high level of interactions between portfolio components, demand the implementation of additional strategic milestone reviews in the portfolio in order to check the overall direction of strategy over portfolio lifecycle.

The results of interviews indicate that organisations use strategic control mechanisms rather than traditional control processes when portfolio complexity increases. In nine of ten interviews, interviewees stressed the importance of using strategic control processes in a portfolio in order to respond to portfolio complexity. As one Vice-President explained: "*without having a modern and robust control system in place, we are not able to control our strategic and complex portfolios. Our Corporate Strategic Division and our Portfolio Management Centre of Excellence have worked together over the last four years to develop a strategic control framework for our portfolios. Strategic control elements are assessed through implementation of this framework to our strategic portfolios with budgets over US$500m.*"

The results of interviews also revealed that organisations use different strategic control types based on their organisational strategy and their perceptions of control mechanisms. Several interviews highlighted the need for monitoring and controlling assumptions over the life cycle of a portfolio when its projects have a high level of interactions and dependencies. As one Portfolio Director stated: "*I have managed a portfolio with ten projects over the last three years, consisting of three Conceptual Selection projects, four Front End Engineering Design (FEED) Projects and three Investment Study Projects. As these projects share same resources and budget, delays in one project inevitably impact other projects and the Front End Engineering Design projects can often only be continued when exploitable results of Conceptual and Studies projects are known. In this situation I should always systematically*

monitor and control the assumptions of Conceptual and Studies to present investment gate for FEED projects."

The second proposition of this research suggested that there is a positive relationship between portfolio dynamic and the use of strategic management control in a portfolio. Results of regression analysis indicated a positive relation between portfolio dynamic and premise control (Beta=0.491), implementation control (Beta=0.638), strategic surveillance control (Beta=0.463) and special alert control (Beta=0.421). All these relations are significant at $p<0.001$.

Figures 23 to 26 depict the relationship between the use of four types of strategic control in portfolio and portfolio dynamic.

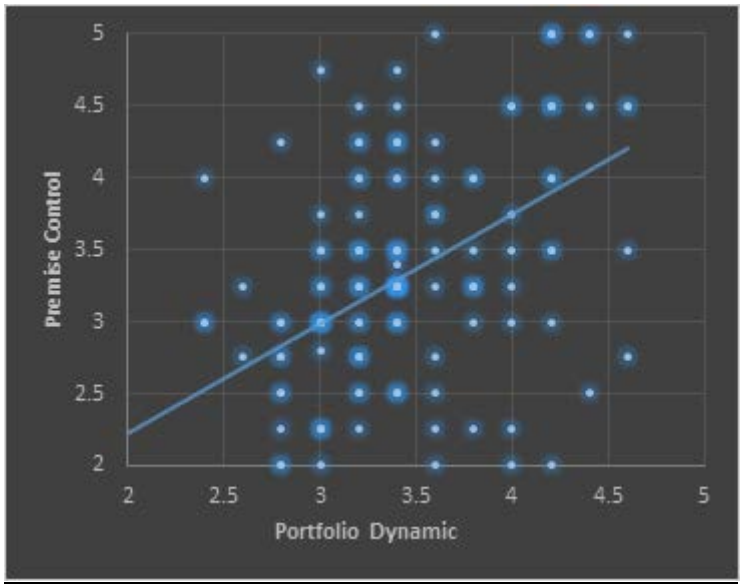


Figure 23: Relationship between Use of Premise Control in Portfolio and Portfolio Dynamic

Use of Premise Control in Portfolio= 0.714+ 0.760 (Portfolio Dynamic)

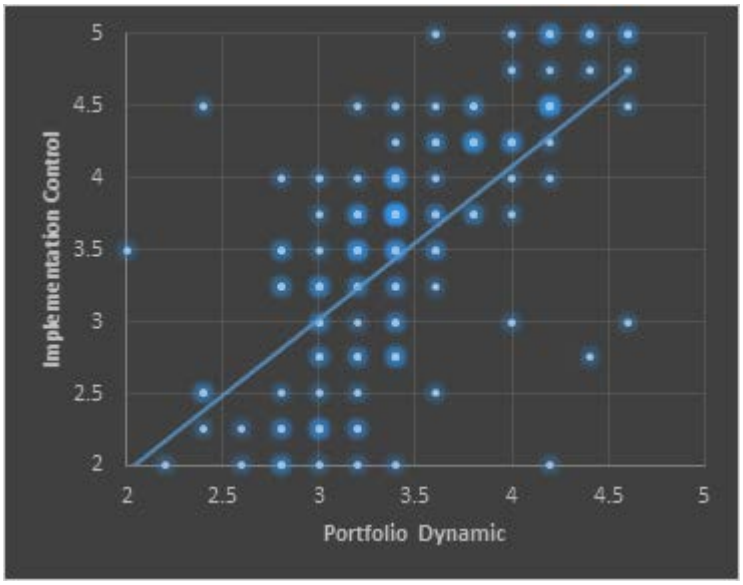


Figure 24: Relationship between Use of Implementation Control in Portfolio and Portfolio Dynamic

Use of Implementation Control in Portfolio= - 0.156+ 1.061 (Portfolio Dynamic)

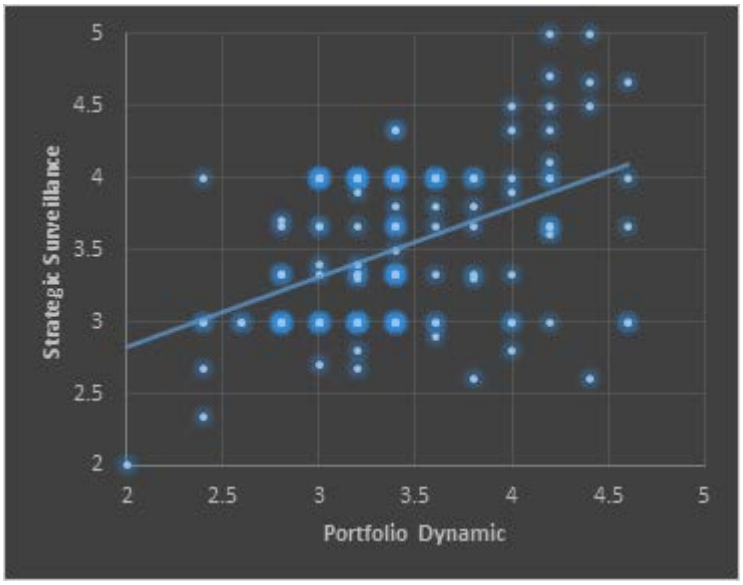


Figure 25: Relationship between Use of Strategic Surveillance Control in Portfolio and Portfolio Dynamic

Use of Strategic Surveillance in Portfolio= 1.853+ 0.486 (Portfolio Dynamic)

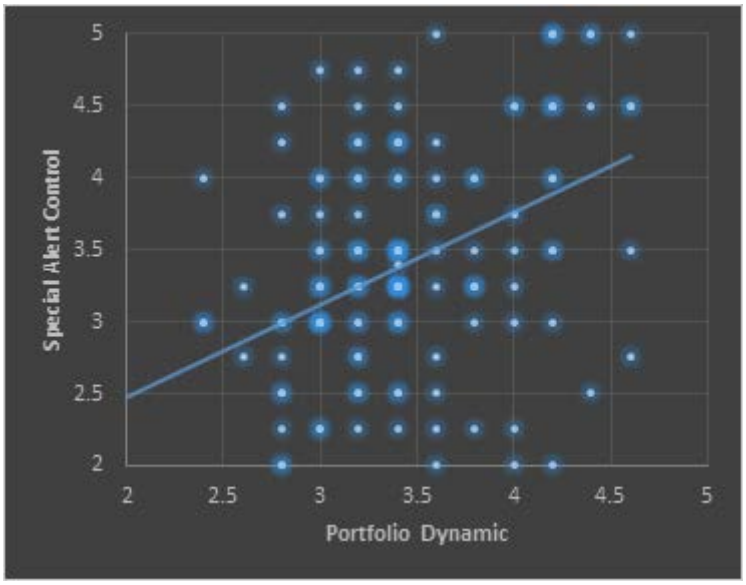


Figure 26: Relationship between Use of Special Alert Control in Portfolio and Portfolio Dynamic

Use of Special Alert Control in Portfolio= 1.197+ 0.642 (Portfolio Dynamic)

"In the project management context, dynamism is taken to be a dimension of a project that represents the extent to which a project is influenced by changes in the environment in which it is conducted" (Collyer and Warren 2009, p. 355). Dynamic environments require frequent iterations, examinations, and milestones in order to respond to environmental changes (Brown and Eisenhardt 1995, p. 353). Organisations manage portfolios in different environments such as different geographical locations, different industries or for different customers need to match several environments simultaneously and manage the interaction between individual changes in different environments. A dynamic environment alters the assumptions that portfolios are started based on those assumptions and those changes bring new risks and opportunities to the portfolio. The traditional control processes are too static to reflect such a rapidly changing environment and respond to new risks and to use new opportunities. Therefore, organisations endeavour to use a more dynamic system to select and monitor the components of their portfolio. The managerial processes of this approach focus of the content of the strategy itself and are completely different from traditional management control (Muralidharan 1997, p. 65).

One General Manager expressed his vision as follows in response to the question of how changing environments affect their management style for controlling

their portfolios: *"We have experienced a high level of uncertainties in our industry over the last ten years. For investment decisions and portfolio selection in some geographic locations, there are many unknown factors. In addition there are many risks and uncertainties during the implementation of portfolios such as legislation and regulation changes, shortage of skilled workers, etc. We continually need to ensure that our portfolios are executed as planned and the strategic objectives of portfolios are achieved. When using traditional control instruments to measure projects cost, schedule and quality against our pre-defined standards and metrics, we need to control the overall portfolio strategy systematically to ensure that portfolio direction is always aligned with portfolio charter and organisational strategy. These kind of controls are carried out by our line managers and consultants who are appointed by a high level manager; we have a decision making system in place to enable our leadership team to get involved at the right time with having right information in order to alternate plans, optimise portfolio or even terminate projects."* The abovementioned quote clearly stated use of an implementation control process and validation of the assumption by the organisation where there are high levels of uncertainty inside and outside of the portfolio.

One Portfolio Director stated: *"To achieve our long term objectives, it is necessary to develop operating and short-term aims that translate our strategy to manageable portfolios and projects. In order to make sure organisational strategic objectives are being met, we need to carefully control those portfolios and their components. We need to keep our control system flexible and agile to be able to respond to internal and external changes in our portfolios and projects in a timely manner. Due to lack of resources in our organisations and an existing turbulent environment, we have to be selective regarding the strategic control system that we use. We do not apply all four strategic control types in all our portfolios and we always select the appropriate one and/or often modify the process in accordance to the complexity and the dynamics of the portfolios. The level of formality of the control system is defined by our portfolio management team and our executive team. In addition when we are unable to define our portfolio objectives clearly, we prefer to only use the operational control system in our portfolio instead of strategic control model or at least use strategic control for tracking portfolios' progress."*

The above quote reflects the view of Goold and Quinn (1990), who believe that in a high dynamic environment, a strategic control system should not be tightly and formally applied. Their framework suggests deployment of strategic control would be problematic when environments are turbulent and an organisation is not able to define and measure precise strategic objectives; however when there is lack of clarity in defining of portfolio objectives, there can be improvement if organisations are able to apply strategic control to measure progress and motivations. In addition, results from the quantitative part revealed there is a stronger correlation between use of strategic implementation control in portfolio and portfolio dynamic than the other three types of strategic control. It means organisations use implementation control more than the other three types of control in their portfolio, while portfolios are experiencing a more turbulent environment.

5.3 Strategic Control and Portfolio Performance

The third proposition of this research suggested there is a positive relationship between use of strategic control system while implementing portfolio objectives and portfolio management performance. This hypothesis was supported and it was concluded that there is a positive and significant relationship between use of strategic control in portfolio and portfolio performance. Table 32 shows the "beta value" for relationships between four factors of portfolio performance and four types of strategic control. The results of regression analysis show there are positive and significant relationships between the four factors of portfolio performance and four types of strategic control. Figures 27 to 30 depict the relationship between use of strategic control and portfolio performance.

Table 32: Correlation Results between Four Factors of Portfolio Performance and Four Types of Strategic Control

Variable	Overall Business Success	Average Project Success	Portfolio Balance	Portfolio Strategic Fit
Premise Control	0.661	0.462	0.558	0.590
Implementation Control	0.692	0.557	0.691	0.652
Strategic Surveillance	0.503	0.340	0.380	0.380

Special Alert Control	0.375	0.283	0.350	0.333

The results revealed that the strongest relationship is between use of implementation control and overall business success (Beta=0.692) and portfolio balance (Beta=0.691), while special alert control and average project success have the weakest relationship (Beta=0283), followed by correlation between special alert control and portfolio strategic fit (Beta=0.333). In addition, the results show that use of implementation control has the strongest impact on portfolio success, while special alert control has the weakest impact on portfolio performance. The results also support the literature as an implementation control measure strategic thrust and this includes milestone reviews (Pearce and Robinson 2011, p. 358), which both contribute to better portfolio success, while special alert control is used to identify high potential threats with low probability (Preble 1992, p. 398), which may not occur during a portfolio life cycle. Literature indicated, while strategic control measures the overall organisational success in achieving strategic objectives and assesses the overall direction of strategy implementation, operational control measures the portfolio and project performance in achieving the cost, schedule and quality standards (Rodrigues and Bowers 1996, p. 129). Comparing the result of analysis for the four factors of portfolio performance supported the literature by indicating that, while use of strategic control strongly correlates to overall business success, it does not have the same strong effect on average project success, because average project success measures the performance of a portfolio in achieving operational metrics such as time, cost and quality.

During portfolio selection as a form of control process (Müller, Martinsuo et al. 2008, p. 35), a portfolio management team needs to select projects based on organisational objectives in order to create portfolio value and increase portfolio performance. By performing premise control within a portfolio, all assumptions for portfolio selection are continuously checked to ensure those premises are still valid and reliable. Projects should be re-prioritised based on premise control outcomes, if any of the assumptions that the selection processes are based on, have been changed during the portfolio life cycle. In addition, over the period of portfolio execution, a portfolio management team defines a series of strategic milestones as part of the implementation control process and measures portfolio strategic objectives to ensure

that the overall portfolio direction is still aligned with the stated organisational strategy. In the light of milestone review outcomes, portfolio strategy, including selection and prioritisation criteria, might be altered. Change in portfolio is a normal occurrence (PMI 2014, p. 51), therefore all internal and external portfolio environments should be consciously monitored for any strategic changes that may affect the portfolio direction. Strategic surveillance has an essential role in the development of a process to identify and interpret organisational changes, which may alter current portfolio components.

One Portfolio Manager stated: *"The portfolio selection criteria are stated in our portfolio strategic management plan. Each criteria used for selection process is linked to our critical business factors. The portfolio selection process is part of our annual strategic review with regular updates. We check all the assumptions in every reporting period and any changes are reported. After each milestone review, we conduct gap analysis to compare current portfolio mix with any new strategic directions and the company's to-be objectives. As the results of gap analysis new projects may be added or existing projects may be changed or terminated. This approach has contributed to a better portfolio balance, and better strategic fit of portfolio within our organisation."*

To increase portfolio value and control strategic objectives of a portfolio including portfolio customer goals, portfolio sponsor goals, portfolio management team expectations and operational performance metrics, organisations need to develop and put expanded methodology in place to provide feedback around internal portfolio activities and also need to add a feedback loop around the results of portfolio execution. This creates a double loop process which balances financial outcomes of a portfolio with qualitative measures. As described in Section 2.2.3, balanced scorecard methodology and critical success factor methods are two kinds of strategic implementation control management systems, which assist organisations to link strategic objectives to portfolio operational performances. Seven out of ten managers stated during the interviews that their respective companies would use either balanced scorecard methodology or critical success factor methods in their organisations in order to measure portfolio performance. One Executive Vice President explained his views in this regard as the following: *""We use formal and informal methods in our company to link our corporate vision to the operational*

targets. We talk about our objectives and visions frequently. We get all the managers together from different levels and discuss our goals and provide all managers adequate information to enable them to link corporate goals to their area of managerial objectives. Back to your question regarding measuring our portfolio performance, well, we use balanced scorecard in our portfolio to measure financial and non-financial indicators and balance objectives during portfolio execution. Our portfolio management teams define interim targets in portfolio strategic management plans, establish milestones in portfolio road map, and link portfolio financial performance to company's annual budget. We measure portfolio performance by three different indicators: financial, customer and internal factors. It is important for us to deliver strong financial results, on spec and on time, as well as keeping the customers satisfied and employees motivated. For example in our portfolio, we measure financial data such as ROCE (Return of Capital Employed), Cash Flow, Portfolio Risk-adjusted return, plus non-financial data such as degree of alignment, sustainability, Health & Safety performances and compatibility to legal and regulatory compliances."

One Portfolio Director stated: *"By using balanced scorecard methodology in my portfolio, I am able to measure the portfolio performance comprehensively from both strategic and operational points of view and decide about future of the portfolios based on the feedback from completed action. To create value to organisation and increase portfolio success, I use tangible and intangible factors to measure portfolios' performance. Within the portfolio we as a team always ask ourselves three important questions: (1) how are we doing for our shareholder in regard to financial benefits? (2) how satisfied are our portfolio sponsors and portfolio stakeholders? and (3) how well are we performing in value creation and continuous improvement? By combining those factors we are able to strategically measure our portfolios' performance."*

Figure 27: Relationship between Use of Strategic Control in Portfolio and Overall Business Success

Overall Business Success= 1.456+ 0.629 (Use of Strategic Control in Portfolio)

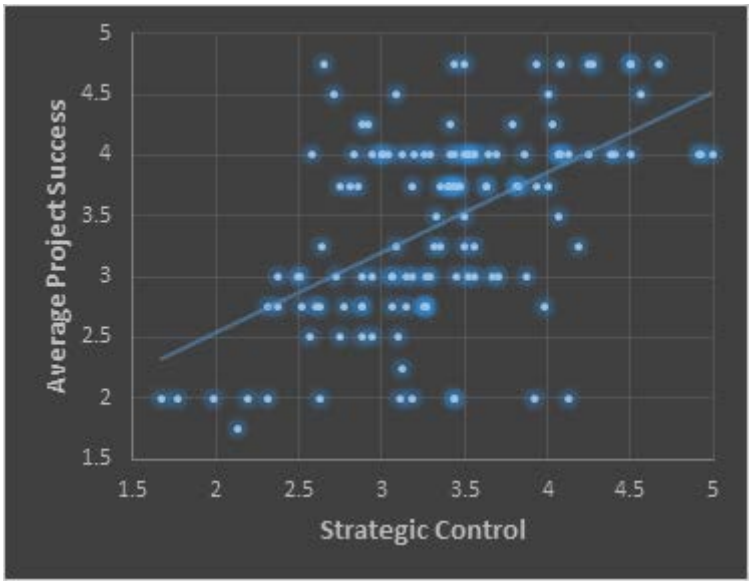


Figure 28: Relationship between Use of Strategic Control in Portfolio and Average Project Success

Average Project Success= 1.239+ 0.655 (Use of Strategic Control in Portfolio)

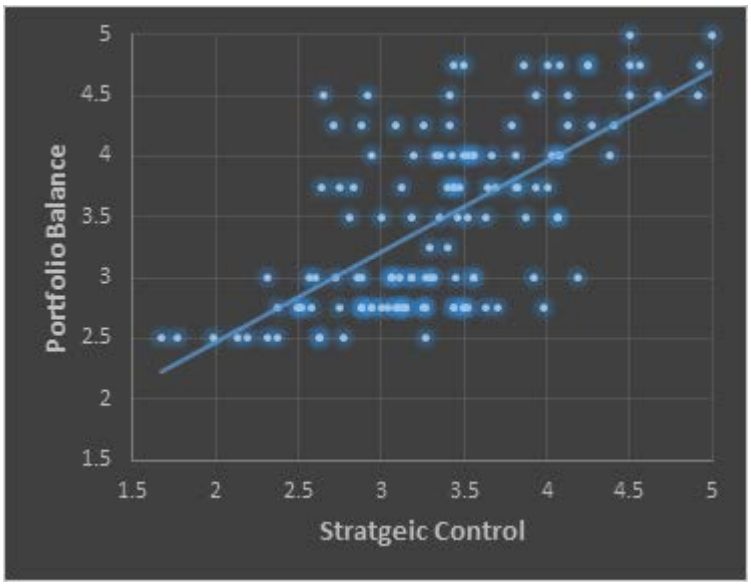


Figure 29: Relationship between Use of Strategic Control in Portfolio and Portfolio Balance

Portfolio Balance= 0.994+ 0.714 (Use of Strategic Control in Portfolio)

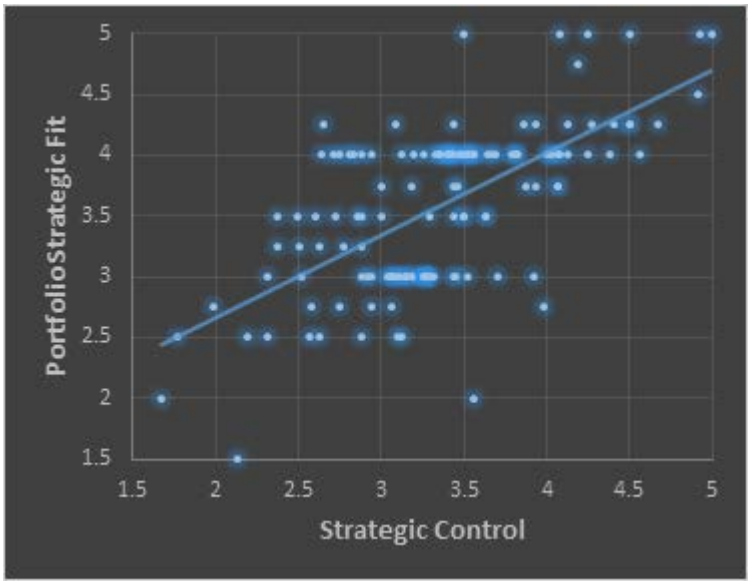


Figure 30: Relationship between Use of Strategic Control in Portfolio and Portfolio Strategic Fit

Portfolio Strategic Fit= 1.307+ 0.677 (Use of Strategic Control in Portfolio)

One research question driving this study is whether portfolios in which the portfolio management team deploys a strategic control system have better performance than portfolios in which the portfolio management team deploys only a traditional control system.

The result of the Student t-test (presented in Table 22) shows that the performance of the group of portfolios using four types of strategic control processes, was significantly higher than the performance of the group of portfolios using other traditional control systems. Figures 31 to 34 show the mean for each of four portfolio performance indicators. Group 1 (N=72) represents the portfolios in which their managers use a strategic control process and Group 2 (N=58) represents the portfolios in which their portfolio management team does not use a strategic control process or uses only a traditional control system in portfolio.

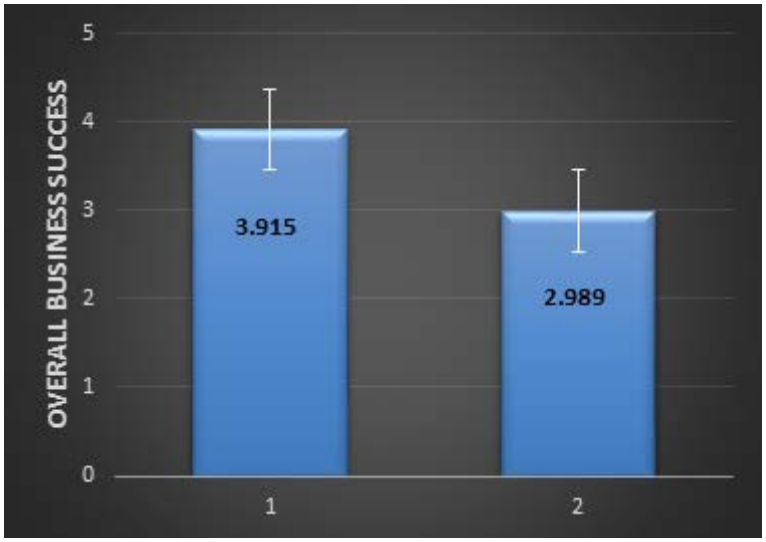


Figure 31: Mean for Overall Business Success

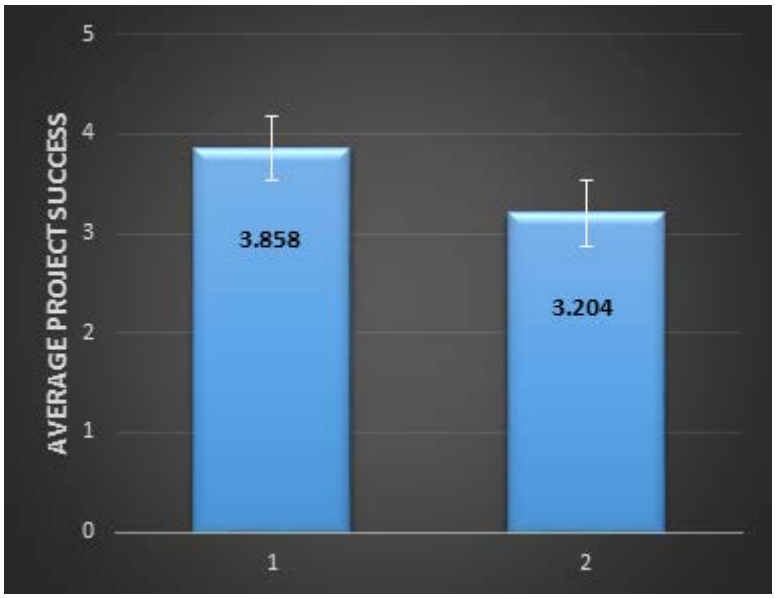


Figure 32: Mean for Average Project Success

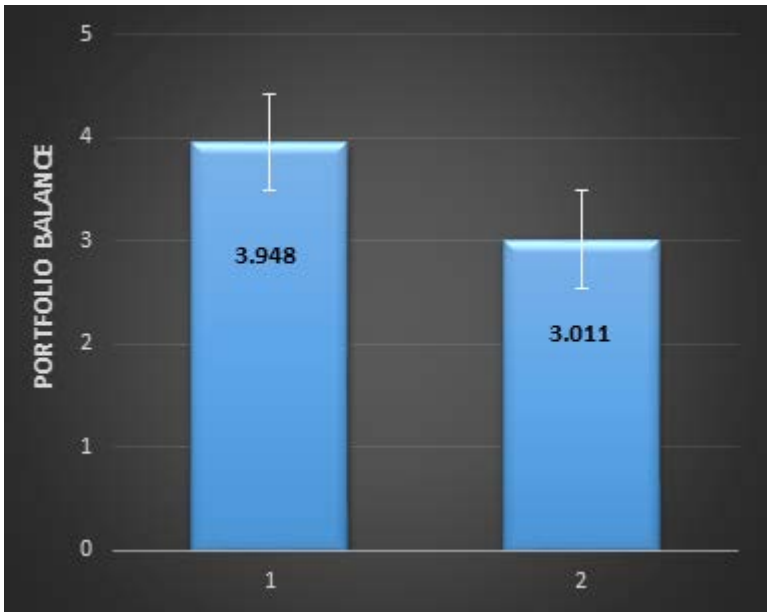


Figure 33: Mean for Portfolio Balance

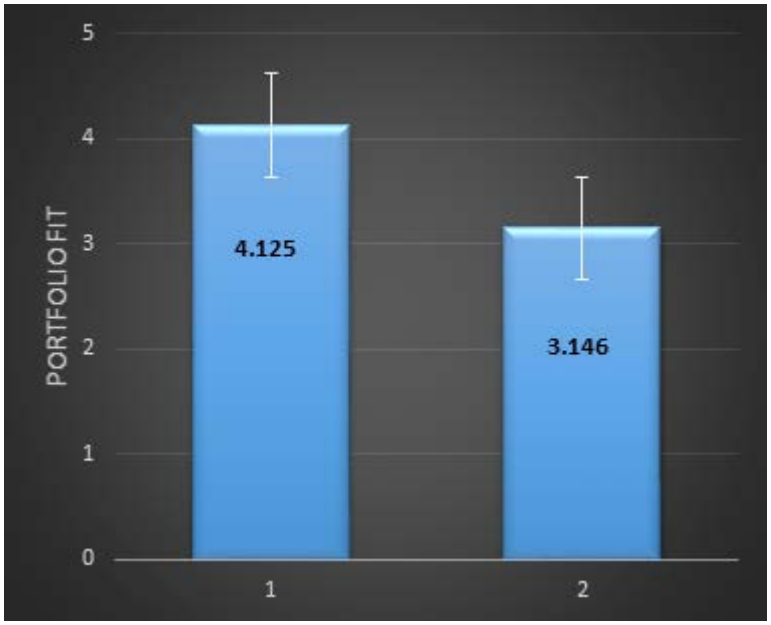


Figure 34: Mean for Portfolio Strategic Fit

The empirical results of the study show that successful portfolios use at least one of four types of strategic control and have a systematic practice to apply strategic control processes in a portfolio. Results indicate the following about organisations that use strategic control in their portfolio.

1. They have a better business performance including profitability, market share and future growth (3.91 vs. 2.99). In portfolio and project-based

organisation, a portfolio of projects is the key driver of organisational goals and is the main resource of revenue. The outcomes of portfolios directly affect the organisation's probability, growth and shareholder value (Pearce and Robinson 2011, p. 365). Therefore those outcomes should be controlled strategically and metrics of control should be extracted from corporate strategies. Implementing a strategic control system in portfolio is one the key contributors to a better portfolio performance and accordingly, to a more successful organisation.

2. Projects of a portfolio have a higher rate of success, including achieving time, cost, quality standards and stakeholder satisfaction (3.86 vs 3.20). The strategic control system as a dynamic model facilitates the strategic management of projects in a portfolio, including development of a process model, creating of an organisational structure, planning, scheduling, cost control and risk management processes. Projects are controlled as part of strategic programmes and project control metrics are linked to organisational strategy.

3. Portfolios are more balanced in terms of portfolio risks, portfolio cash flow and pipeline of new projects (3.95 vs. 3.01). Literature indicated that reaching a proper balance of risk, timing, diversity, and return on investment is critical to the selection of projects in a portfolio (N. Archer 2004, p. 241). The selection criteria, which are extracted from organisational strategy, should be checked methodically and continuously over a portfolio life cycle to ensure they are valid (Premise Control). Optimisation of a portfolio and retaining the optimal balance of a portfolio, require (1) feedback from the strategic control process and (2) termination and/or addition of projects based on the strategic control process outcomes (implementation control). For achieving and retaining a balanced portfolio, in addition to the two above strategic control types, internal and external portfolio environments should be checked for any potential threats and opportunities that may affect the portfolio and its strategy (Strategic Surveillance Control).

4. Portfolios are more strategically aligned with organisational strategy and resource allocation processes are implemented in a more cost effective manner (4.21 vs. 3.15)

The results of the quantitative part are also supported with interviews conducted. As one CEO of a successful organisation said: *"I was appointed as CEO and managing director of this company seven years ago, when the company was suffering from cash flow and market share problems. The first question for me was: Why do projects perform poorly despite the mature project management systems that we had in place? I believe the main reason for project cost overrun and schedule problems is the static nature of project management view and its tools and techniques. We developed and have implemented a dynamic management system in a series of portfolios. We call the system "SPMS" standing for Strategic Portfolio Management System. By implementing this system, revenues and profits have grown by 82% and 125% respectively over a period of four years. The main characteristics of the system are (1) it is linked to our corporate strategy (2) it is dynamic and it works based on the double loop control process which provides mid-course corrections (3) it systematically and continuously monitors internal and external environments for any new threats and opportunities in order to make required adjustments to portfolio's strategy."*

The positive relationship between use of strategic control in a portfolio and portfolio performance is moderated by portfolio size, portfolio interdependency and portfolio dynamic. These relationships were tested through hypotheses 5, 6 and 7 and the results of the regression analysis presented in Table 23, Table 24 and Table 25 showed the positive impact of use of strategic control in a portfolio will be higher when portfolio size, interdependency and dynamic increase.

Portfolio size has the positive and significant effect on relationships between use of strategic control types in a portfolio and portfolio performance. This interaction is stronger for implementation control (beta= 0.697) than the other three types of strategic control. Portfolio size has the weakest effect (beta=0.478) on the relationship between use of special alert control and portfolio performance. It is logical that portfolio size has a stronger impact on implementation control and premise control (beta=0.600), because by increasing the size of a portfolio, the need for milestone reviews and monitoring of assumption increases. The companies are

divided into two groups including large profile size organisations and small profile size organisations. The simple slopes for each of two categories are presented in Figure 35. It shows that for smaller portfolios the effect is still positive but weaker than large portfolios.

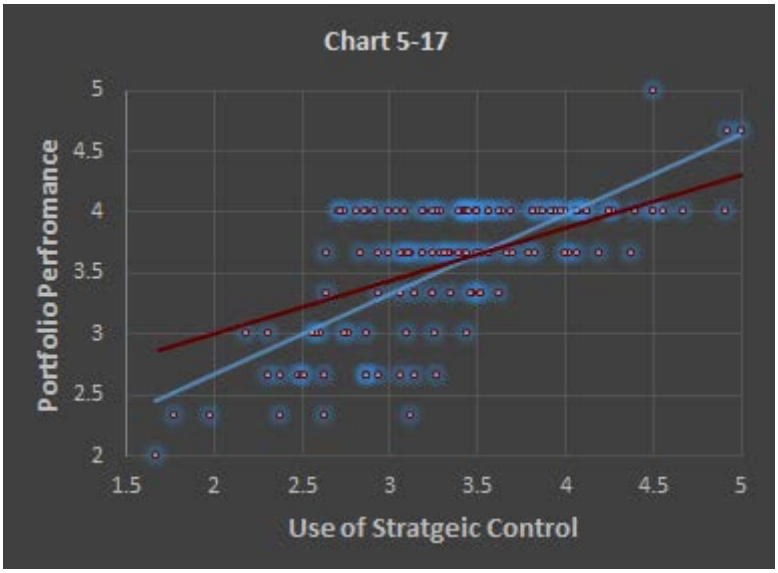


Figure 35: Simple Slope for Moderator Portfolio Size

Portfolio interdependency has a positive and significant effect on interaction between the use of four types of strategic control and portfolio performance. This effect is significantly stronger for implementation control (beta=0.720) in comparison of premise control (beta=0.532), strategic surveillance (beta=0.485) and special alert control (beta=0.456). When a series of interdependent projects that share resources and budget are executed, a portfolio may receive more benefit than a simple sum of benefits that are received from each individual project (Xingmei Li Shu-Cherng Fang Xiaoling Guo Zhibin Deng Jianxun 2016, p. 121). However, a more robust control system would be required to manage all interfaces between projects to achieve a higher performance. The results are supported by the view of Dickinson et al. (2001, p. 518) and Kock et al. (2016, p. 124) who point out optimising even a moderate number of interdependent projects over a small number of objectives and constraints would be complex and difficult. In this complexity it is logical and even more necessary to implement a strategic control system to manage project interdependencies.

By implementing a strategic control process in a portfolio, the portfolio management team is able to continuously check the results of projects, which are considered as assumptions for new projects. This approach reduces the risk of starting a new project that does not support organisational strategy. In addition, by implementing joint milestone reviews as part of strategic implementation control, the impact of individual project scope changes can be checked and managed on other projects within the portfolio, which can contribute to a better performance. The result of regression analysis revealed that the relationship between use of strategic control and portfolio performance can be positively moderated by increasing the project interdependency in portfolios. This relationship and effect of interdependency are visualised in chart 5-18 for two groups of high and low portfolio interdependency. The two simple slope graphs depict that for low portfolio interdependency, the effect is still positive but weaker than high portfolio interdependency.

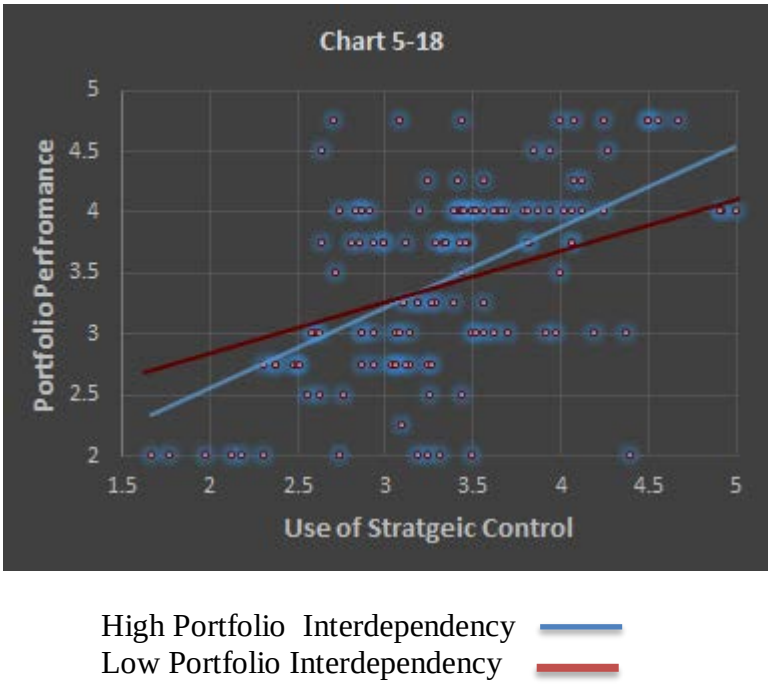


Figure 36: Simple Slope for Moderator Portfolio Interdependency

The effect of portfolio dynamic on relationship between use of strategic control in a portfolio and portfolio performance is tested through hypothesis 7 and it is supported by performing regression analysis between variables. Similar to portfolio

size and portfolio interdependency, the effect of the portfolio dynamic is stronger on relationship between implementation control and portfolio performance (beta=0.664) than the three other types of strategic control. In a turbulent environment where the rates of internal and external changes are high, it is important that organisations implement a dynamic and agile strategic control system to respond to constant changes in a timely manner in order to achieve stated portfolio objectives. The effect of portfolio environmental turbulence (dynamic) on the interaction between portfolio performance and strategic control are showed in Figure 37 for two groups of high and low portfolio dynamic. The two simple slope graphs show this effect resembles the effect of portfolio size and interdependency. It indicates that for a low portfolio dynamic environment, the effect is still positive but weaker than a high portfolio dynamic.

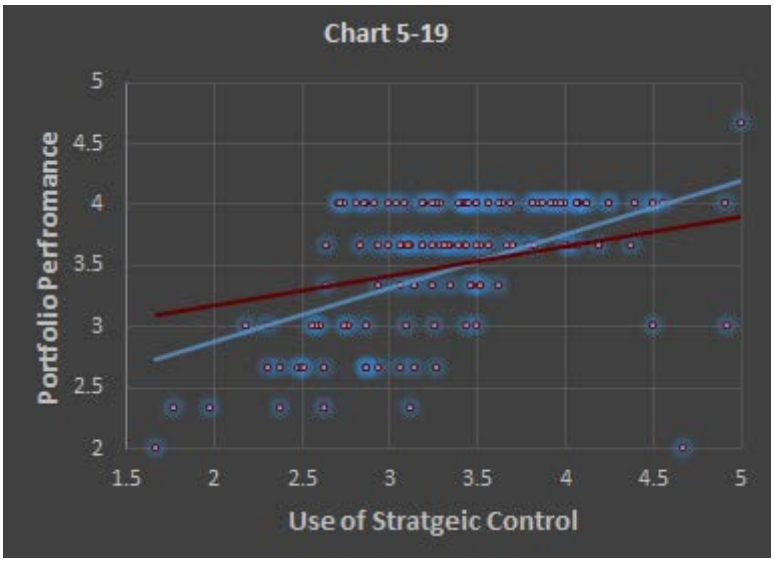


Figure 37: Simple Slope for Moderator Portfolio Dynamic

Portfolio size, interdependency and dynamic add to the complexity of the portfolio management system and highlight the requirement for a strategic control approach over the common traditional control system. In other words, all three abovementioned findings suggest that implementation of strategic control becomes even more important for organisations running large project portfolios with many interdependent projects in a turbulent and dynamic environment. The approved

hypotheses 6, 7 and 8 strengthen previous findings, which indicate that the relationship between portfolio control and portfolio management performance is moderated by contextual factors (Müller, Martinsuo et al. 2008, p.32). The results show the importance of a control system in the success of portfolios and respected organisations.

In addition, the results of analysis revealed that among the three moderating variables (portfolio size, interdependency and dynamic), portfolio interdependency has the strongest effect on the relationship between strategic implementation control and portfolio success (beta=0.720 vs 0.697 & 0.664 for portfolio size and portfolio dynamic respectively, see Table 23, 24 and 25).

In proposition 8 of this research, the use of strategic control in a portfolio, as an independent variable, was hypothesised to impact portfolio performance, as a dependent variable, moderated by organisational approaches to governance. It claimed the governance type of the organisation positively moderates the relationship between use of strategic control and portfolio management performance.

The four performance indicators, including overall business success, average project success, portfolio balance and portfolio strategic fit are compared for four organisational governance types including multi-project organisations, programme driven organisations, portfolio driven organisations and hybrid organisations. One-way ANOVA in combination with the Scheffe procedure was performed in order to analyse the difference in the means of performance for four types of governance approach. The results revealed that:

1- For all four types of strategic control, performance indicators for hybrid organisations are significantly higher than other governance types. The results of Student's t-test also show significant difference for all four performance indicators ($p<0.0005$) between mean of performance for hybrid organisations and means of performance for the other three types of governance. The results are aligned with findings of a study conducted by Blomquist and Müller et al. (2006, p. 67) that stated that hybrid organisations are significantly more successful that companies using one of the other three types of governance. In addition, previous results indicate hybrid organisations as well-prepared and mature project-based organisations, which have a higher degree of portfolio control in terms of

portfolio selection, portfolio reporting and decision-making style (Müller, Martinsuo et al. 2008, p. 38).

2- Figures 38 to 41 show the mean for each of four portfolio performance indicators. Group 1 (N=44) represents hybrid organisations and Group 2 (N=86) represents other governance mechanisms. Charts show the biggest difference between the means of two groups belongs to overall business performance (Δ=1.027); it is followed by portfolio strategic fit (Δ=1.013) and then portfolio balance (Δ=0.943), and the smallest difference is for average project success (Δ=0585). It is logical that by implementing strategic control in a portfolio, the performance of indicators that reflect strategic objectives (overall business success, strategic fit of portfolio and portfolio balance) should be better than indicators that reflect the operational performance (average project success).

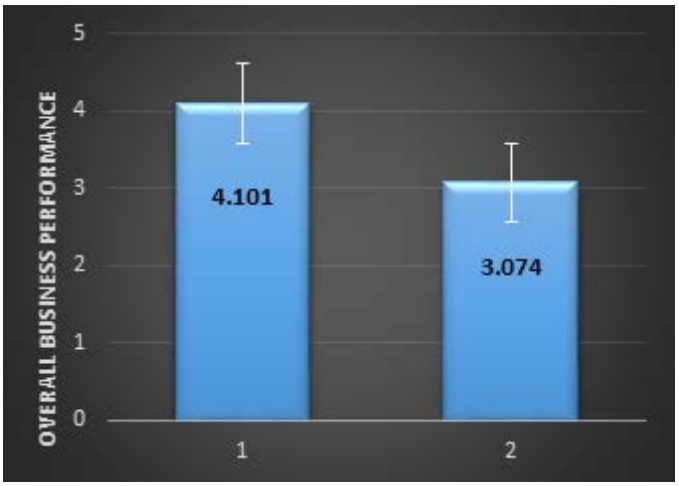


Figure 38: Means for Overall Business Success in Hybrid Organisations and other Governance Mechanisms

3- The mean for performance in portfolio management-driven organisations is significantly higher than the means of performance of programme management and multi-project organisations while implementing premise control and implementation control in a portfolio. The results support literature that states successful organisations differ in their use of portfolio control mechanisms, based on their approach to organisational governance (Müller, Martinsuo et al. 2008, p. 38).

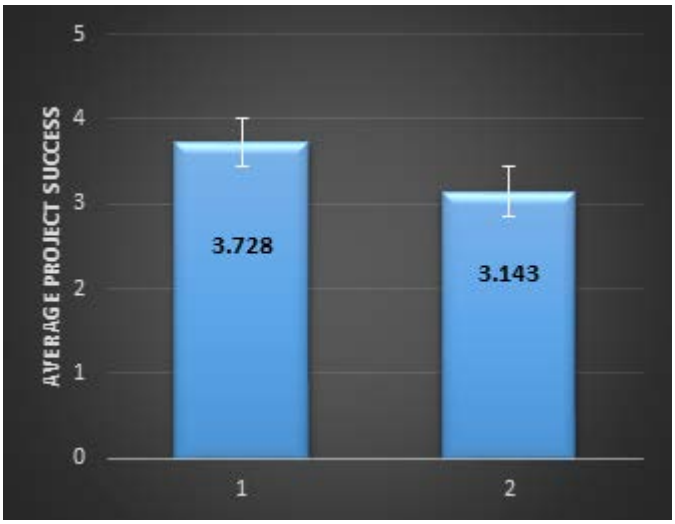


Figure 39: Means for Average Project Success in Hybrid Organisations and other Governance Mechanisms

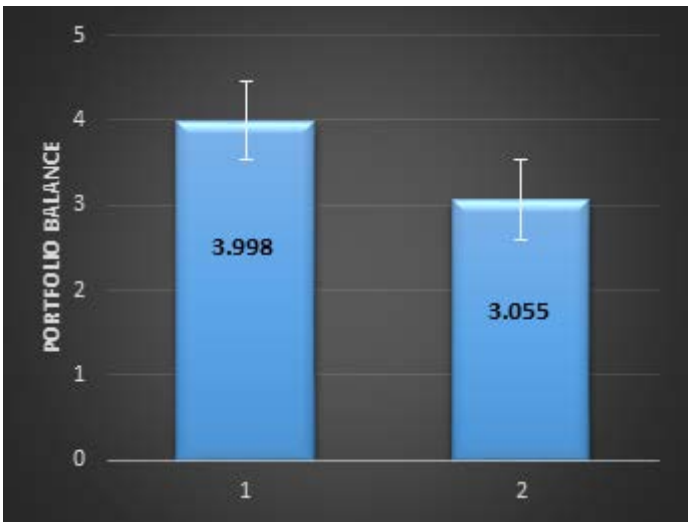


Figure 40: Means for Portfolio Balance in Hybrid Organisations and other Governance Mechanisms

4- There is no significant difference between means of performance for portfolio management, programme management and multi-project organisations while implementing strategic surveillance and special alert control in a portfolio.

By considering the four abovementioned results, it can be concluded that at least governance types should be taken into account when selecting portfolio control mechanisms for a portfolio.

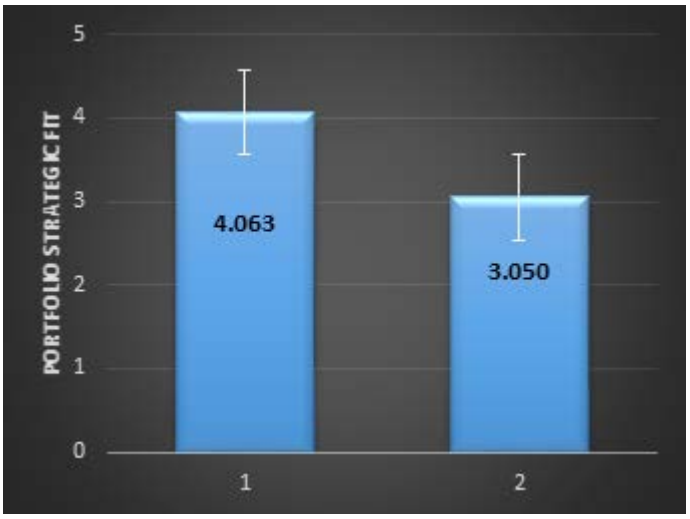


Figure 41: Means for Portfolio Strategic Fit in Hybrid Organisations and other Governance Mechanisms

5.4 Summary

This chapter discussed the research findings by relating the results to the research objectives and literature. It was learned that research findings were supported by previous literature on the link of strategic control and organisational success and also those on the link of control system and portfolio performance. Also the qualitative analysis of the interviews indicates support for quantitative research findings. Based on the approved research hypotheses, the final model for the relationship between portfolio strategic control and portfolio performance and the moderating effects of context are developed and are presented in Figure 42. It shows the relationship between use of strategic control mechanisms (premise control, implementation control, strategic surveillance and special alert control) and four indicators of portfolio management performance (overall business success, average project success, portfolio balance and portfolio strategic fit). It also depicts that this relationship is moderated by contextual factors including portfolio size, portfolio interdependency, portfolio dynamic and organisational governance type.

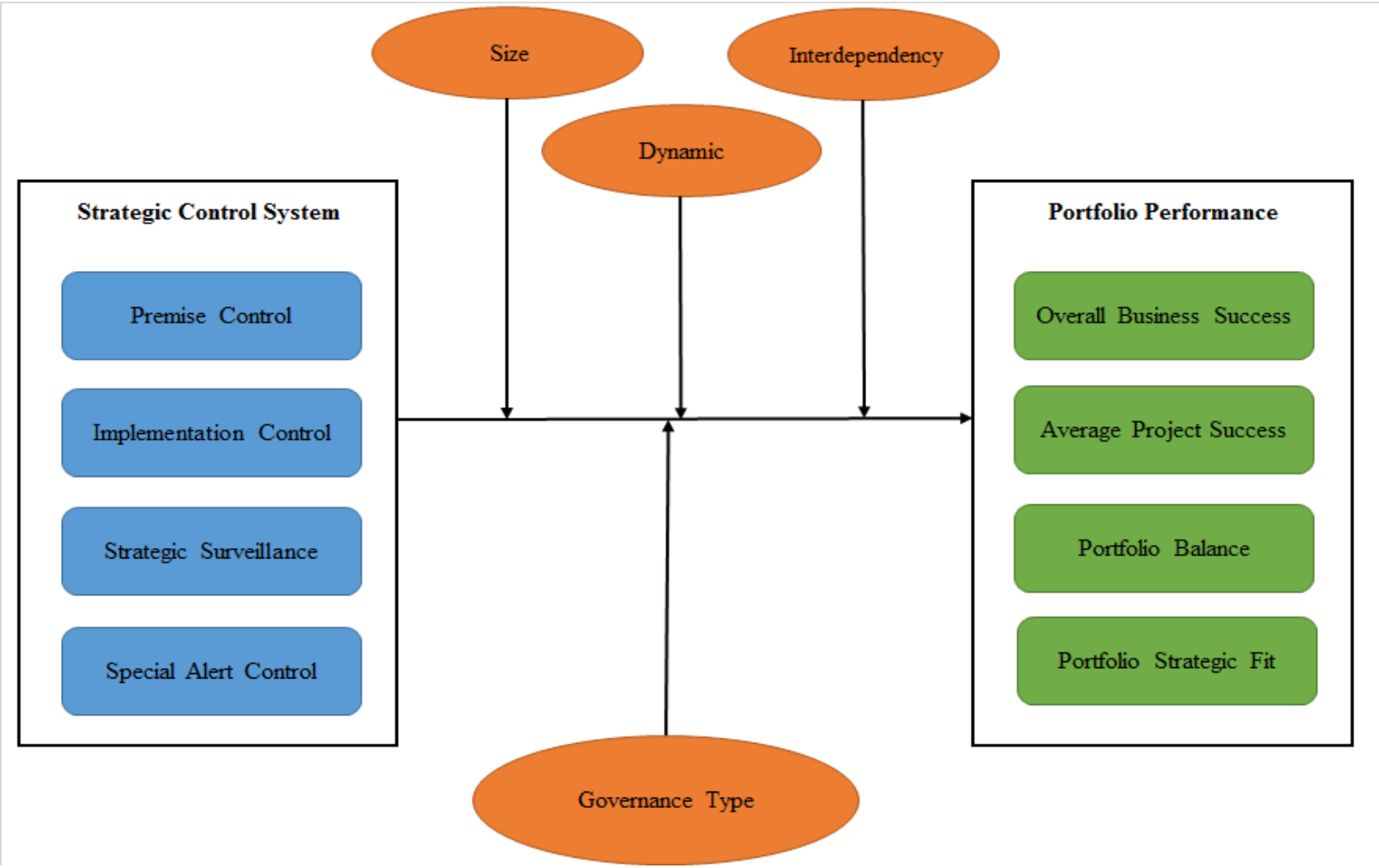


Figure 42: Final Research Model

Chapter 6: Conclusions

This chapter provides a summary and conclusion of the research outcomes. It discusses the implication of the research findings and the recommendation made based on the results of the study. Section 6.1 retraces the line of argument by restating the research questions and the need for this study. Section 6.2 summarises previous chapters and research findings, section 6.3 discusses the theoretical and practical contribution of the research and section 6.4 describes research limitations and provides recommendations for future research.

6.1 Retracing Research Questions

This study has developed the concept of using strategic control in portfolio management and analysed its association with portfolio management performance in different contextual factors including portfolio size, portfolio interdependency, portfolio dynamic and organisational governance mechanisms. Based on the primary focus of what to control, control of portfolio can be distinguished by two main approaches: strategic control management and operational control management. Portfolios as the main driver of organisational strategy implementation, are set to achieve certain objectives under the constraints of time, budget and other resources. Therefore, a portfolio should be operationally controlled in order to meet time, cost and quality standards, as well as being strategically controlled to ensure that the overall portfolio direction is aligned with organisational strategy. Past studies concentrated on applying strategic control in organisations and scholars reviewed the role of strategic control system in organisational performance. The limited research on the utilisation of strategic control mechanisms in the portfolio environment and the gap between the academic research and practical application of a strategic control process in industry were clear signs of the need for this study. This study expected to extend the understanding of strategic control system implementation in portfolio management, as the first primary research question asked: *how are portfolios strategically controlled and what kind of strategic control mechanism may be deployed in a portfolio?* Such an understanding would improve a firm's knowledge on linking portfolio objectives with organisational goals and selecting an appropriate

control mechanism in order to monitor portfolio strategic direction and control the progress of achieving portfolio strategic objectives. In addition, this research took theoretical studies of strategic control and portfolio management, obtained experiences of industry leading organisations regarding their portfolio control approaches and provided empirical data on the link of strategic control and portfolio management performance, as the second main question of this research asked: *how does strategic control relate to portfolio performance and what are the moderating contextual factors?* This link provided a conceptual model on the interaction of four types of strategic control and four indicators of portfolio performance in different situations. The moderating effects have an impact on the strategic control system in order to be effective in controlling strategic targets of a portfolio in a changing environment.

6.2 Summary

Chapter 1 of this research introduced the background to the research, the research problems, the purpose of this study and its significance, and the definition of terms used in this research. This study is developed based on the assumption that there is a lack of theoretical knowledge for implementation and the use of a strategic control system in portfolio management during the execution of portfolio objectives. It is also important to understand how this interaction affects portfolio performance in different situations. It does not matter how good organisations formulate and implement strategies, if those strategies cannot be effectively and efficiently controlled. A similar concept is applicable to a portfolio of projects as a temporary or permanent organisation in a firm. This concept was the start point of this study and was the major driver for the development of research questions.

Chapter 2 reviewed the literature that is intended to develop the research questions, hypotheses, and research model. First it looked at strategic control mechanisms in organisations and their difference with traditional control systems. Major theoretical frameworks for strategic control were reviewed, characteristics of different approaches were identified and four types of strategy including premise control, implementation control, strategic surveillance and special alert control were selected as a set of research variables. The study also looked at portfolio management, strategic portfolio management and the importance of linking

portfolios to organisational strategy. From the literature, it was learned that the objectives of a portfolio are the lowest-level output of an organisational strategic control process, intended to assist organisations in achieving high level objectives. Therefore it is essential to have a feed-forward double loop control system additional to the traditional control process to monitor progress of those strategic objectives as well as assessing overall portfolio strategy continuously. The study also reviewed literature on the portfolio selection and portfolio optimisation as a means of control mechanism in the portfolio, and effective instruments that are supposed to assist in achieving organisational goals. As well, portfolio management performance was reviewed and it was indicated that it would be important to measure portfolio performance by multidimensional factors and from project, portfolio and corporate levels. Lastly, contingent variables from organisational level, portfolio level, and environmental level were reviewed and four contingent variables including portfolio size, portfolio interdependency, and portfolio dynamic and governance type were selected as moderating variables. At the end, the two major research questions, eight research hypotheses, and high level research model were presented.

Chapter 3 described the research methodology and research design, including data source and collection methods, analysis approach and instruments used. It was explained that the research design is a sequential, dual approach combining qualitative and quantitative methods to take advantage of both methodologies. The qualitative part of the study consisted of ten semi-structured interviews with high executive managers from seven successful organisations. The qualitative part assisted in the development of quantitative survey questionnaires and added richness to the quantitative findings. Primary data for the quantitative part of the study, were collected through questionnaires sent to the companies under study. The total of 130 responses out of 174 distributed questionnaires was used for data analysis. All research variables were operationalised, based on the literature and interviews and each of the variables was defined by a set of factors, which were rated according to the 5-point Likert Scale.

Chapter 4 presented statistical analysis of the research questions and their associated hypotheses. To test relationships among variables, a series of statistical methods including standard deviation, mean, Pearson's R test, multiple regression analysis, Student's t-test method, and analysis of variance (ANOVA) were used in

order to analyse research data and to test research hypotheses. Cronbach Alpha was used to verify the scale for variables measured. This study examined use of four types of strategic control including premise control, implementation control, strategic surveillance and special alert control in portfolio management and their relationship between portfolio management performances in different situations. In support of hypotheses 1 and 2 it was discovered that there is a positive and significant relationship between use of the strategic control process in a portfolio and portfolio complexity as well as portfolio dynamic. The results showed organisations have a greater tendency to use strategic control processes in their portfolio in more dynamic environments and more complex portfolios. In support of hypothesis 3, it was revealed that there is a positive and significant relationship between use of the strategic control mechanism in portfolio and portfolio management performance. Results indicated that utilisation of each type of strategic control may contribute to portfolio success and may create more portfolio value over portfolio lifecycle. Premise control in this case is responsible for monitoring strategic assumptions of the portfolio to ensure that all formulated assumptions upon which the portfolio is based, are still valid and reliable. Implementation controls monitor the overall strategy direction in light of results provided by operational control mechanisms and strategic milestone reviews. This assists the portfolio management team in performing a full scale assessment of the implementation phase to provide required information for making decisions regarding overall portfolio direction and objectives. Strategic surveillance is responsible for monitoring a broad range of internal and external events of the portfolio which are likely to impact portfolio strategy and objectives. Special alert control is supposed to identify high level threats to a portfolio and develop required action plans to respond to those threats in a proper and timely manner. In support of hypothesis 4, it was discovered that organisations that use a strategic control mechanism in their portfolio have better performance that organisations which do not use strategic control or use only traditional control in their portfolio. The results of analysis showed that means for all four performance indicators, including overall business success, average portfolio success, portfolio balance and portfolio strategic fit, are higher for organisations that use strategic control in their portfolios. In support of hypotheses 5, 6 and 7, it was revealed that the positive relationship between use of strategic control in a portfolio and portfolio performance is moderated by a set of contingent variables including portfolio size,

portfolio interdependency and portfolio dynamic. In support of the last hypothesis, it was revealed that organisational governance type as a moderating variable has a positive impact on the relationship between use of strategic control in portfolio and portfolio performance. The results showed that hybrid organisations, which combine and balance project, programme and portfolio management approaches, have better portfolio performance while implementing strategic control in their portfolios. All four dependent variables of performance of the hybrid organisations are significantly higher than that of the other type of governance.

Chapter 5 discussed the research findings by relating the results to the research objectives and literature. It was learned that research findings were supported by previous literature on the link of strategic control and organisational success and also those on the link of control system and portfolio performance. Also the qualitative analysis of the interviews indicates support for quantitative research findings.

6.3 Theoretical and Managerial Contribution

This study provided empirical evidence on the relationship between use of strategic control in a portfolio, and portfolio complexity and portfolio dynamic. It also revealed that the positive and significant relationship between use of strategic control in portfolio and portfolio management performance is moderated by contextual factors of portfolio size, portfolio interdependency, portfolio dynamic and organisation governance type. The final model on this relationship is presented in Figure 42.

The research contributes to the stream of portfolio management and strategic control literature by introducing utilisation of strategic control in portfolio management. The study supports existing theories on the impact of contextual factors on strategic control mechanisms (Fiegener 1990, Goold and Quinn 1990, Muralidharan 1997, Julian and Scifres 2002) by analysing implementation of strategic control in a dynamic and complex portfolio environment. The study expands existing theories on the relationship of strategy and organisational performance (White 1986, Cooper, Edgett et al. 1997, Solieri 2000, Sanchez and Robert 2010). The study reaffirms that the portfolio management process should be a dynamic decision mechanism (Cooper, Edgett et al. 1997) where organisational strategy is linked to portfolio and project objectives (Shenhar 1999, Morris and

Jamieson 2005, Shenhar 2007, Turner 2014). The study also supports existing study on the link of a control system with a portfolio management success factor in different contexts (Blomquist, Müller et al. 2006, Blomquist, Müller et al. 2006, Müller, Martinsuo et al. 2008). The results of the study also reveal that high performance portfolios have a greater tendency to use a strategic control system, than a low performance portfolio. It supports the studies on the need of dynamic and robust control processes in portfolios for achieving predetermined portfolio objectives (Rad, Levin et al. 2006). This research also indicates that portfolio selection, prioritisation, and optimisation processes should be strategically controlled, all selection and optimisation assumptions should be checked continuously and they should be updated based on internal and external changes (PMI 2014). In addition, the study expands the use of the balanced scorecard (Kaplan and Norton 1992, Kaplan and Norton 1996, Pearce and Robinson 2011) and critical success factor (Rockart 1979, Wijn and Van Veen-Dirks 2002) to the portfolio management process.

The study results indicate the following practical recommendations:

- Review portfolio progress periodically by multidimensional factors and based on a series of financial and nonfinancial, qualitative and quantitative metrics in organisations;
- Establish organisational standard procedure for selection and optimisation of portfolios based on organisational objectives, and control the process by strategic control mechanisms;
- Respond to organisational strategy shifts, by implementing a strategic control mechanism which enables a portfolio to compare “as is” situation with “to-be” situation and also by conducting strategic gap analysis;
- Implement balanced scorecard and critical success factors methodologies in portfolios;
- Define strategic milestones reviews in portfolios in addition to schedule and cost milestone review.

6.4 Research Limitations

The scope of this study was limited to the research problems which were discussed in Chapter 2. The following items describe the resulting limitations of this research:

1. Qualitative part of this research is heavily reliant on individual perceptions and views regarding using strategic control mechanisms at portfolio level; However, it should be considered that all ten individuals were interviewed are C-Level Executives who hold key position at market leading and successful large and medium-sized international business firms.
2. The scope for qualitative data gathering of this research including interviews was limited to Energy Industry (including: Oil, Gas, Petrochemical and Chemical Sectors), Construction and Utility Industries.
3. The scope for quantitative data gathering of this research was limited to Energy (including: Oil, Gas, Petrochemical, Chemical and Renewable Energy Sectors), Mining, Construction, Utility, IT and Financial Industries.
4. The responses by each participant in the interviews were completely dependent on his or her personal perceptions and experiences.
5. Portfolio performance was measured from the perspectives of maximum of three stakeholders in organisations; the views of other stakeholders, including customers, were not considered.

6.5 Suggestions for Future Research

As the first empirical study on using strategic control mechanisms in the portfolio management process and its link to portfolio management performance, the study opens up many possible areas for future research. The following suggestions are derived from research findings in connection with existing literature.

1. The objective of this study was to start a research programme in order to develop a comprehensive contingency framework for portfolio

strategic control, which enables organisations to strategically control their portfolio in a standard fashion. Therefore it is recommended that future research expands the research model in order to develop a comprehensive strategic portfolio contingency model.

2. Refine and elaborate on the research model and conduct studies on the relationship of each strategic control type and the portfolio success factors in different situations;

3. The four types of strategic control also can be applied to the project management environment, therefore it is suggested that future research, study the relationship of project management elements including Project Strategy, Organisation, Process, Tools, Metrics, and Culture (Shenhar 1999) with four types of strategic control; also finding an answer to the question of "how different strategic controls suit different project types" can be a new area for research;

4. In this study, four types of strategic control including premise control, implementation control, strategic surveillance and special alert control are used as independent variables, which are related to portfolio performance as dependent variables. It is suggested that future research study the use of other categories of strategic control such as quality, corrective, anticipatory and maintenance controls (Fiegener 1990) in portfolios and their interactions with portfolio performance;

5. This research studied organisations from energy, utility and construction industries, therefore there is a need to study other industries to see whether the findings of this study can be applied to those sectors;

6. This study reviewed three portfolio contingent factors (portfolio size, interdependency and dynamic) and one organisational contingent factor (governance type) and their moderating effect on the interaction of strategic control and portfolio performance. There is a need to study the impact of other contingent variables on this interaction;

7. The result of this study revealed that organisations have a greater tendency to use strategic control in their portfolio in a dynamic and

turbulent environment and this contingent variable moderates the positive relationship between the use of strategic control in a portfolio and portfolio management performance. This finding is not aligned with the Goold and Quinn framework (1990) on strategic control, which claims use of strategic control in a turbulent environment would be problematic. Therefore, there is a need for a new study to review this result and shed light on these two findings.

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Appendices

Appendix A

Interview Questions

1. **Please provide information about your company and the nature of its projects**
   - ✓ Please answer the following questions:
     A) The industry and type of your organisation
     B) The size of your organisation
     C) Your title in organisation
     D) Your geographical location

2. **How do you formulate, implement and control your organisational strategies?**

3. **How do you define the portfolios in your organisation?**

   - ✓ Please explain/elaborate in the following areas:
     A) Portfolio Management Processes
     B) Portfolio Scope definition
     C) Portfolio Success Criteria
     D) Portfolio Monitoring process and Reporting
     E) Portfolio Selection Processes
     F) Portfolio Component Management Relationships

   - ✓ How do you link portfolio objectives with organisational strategy
   - ✓ Do you use the following tools for developing portfolio strategic plan?
     - ➢ Strategic alignment analysis
     - ➢ Prioritisation analysis

4. **How do you measure portfolio performance/values?**

   - ✓ Do you utilise formal portfolio performance management plan in your organisation?
   - ✓ What are the portfolio performance key measurements factors?
   - ✓ How do you report on portfolio performance?

5. **How do you optimise portfolio through its life cycle?**

   - ✓ How does changing environment affect the portfolio strategy?
   - ✓ How do you manage strategic changes in the portfolio?
   - ✓ How do you manage component changes in the portfolio?
   - ✓ How do you performing risk analysis on portfolio components based on your organisation ‘s risk profile
   - ✓ Which kind of the qualitative/qualitative techniques do you use?

6. **What kind of decision-making framework and prioritisation model do you use in your organisation to respond to organisation strategies?**

    - ✓ How do you compare the current portfolio components with the new strategic direction?
    - ✓ How do you use the performance report to implement resource optimisation and benefit realisation?

7. **Do you utilise strategic control components in your organisation to control portfolios? If yes, Please provide answer to the following questions:**

    - ✓ How do you control premises and projections of the portfolios?
    - ✓ How do you control key milestones in the portfolios?
    - ✓ How do you monitor potential threats and opportunities related to portfolio strategies?
    - ✓ How do you monitor recognisable but unlikely events in the whole life cycle of portfolios?
    - ✓ What are the challenges you face during portfolio objective control?

8. **Is there any other information that you see as relevant for this study?**

Appendix B

Questionnaire Instrument

Please provide your view of your organisation as it applies to the question being asked

1. Background Information	
1.1 What is your current age?	
1.2 How many years of business experience do you have?	
1.3 What is your current position?	
1.4 How long have you had this position?	
1.5 which country are you working in?	
1.6 Which industry are you working in?	
1.7 What is your highest level of education?	
1.8 Are you a certified project /programme/ portfolio manager? Please specify	

2. Main Objective of Portfolio	
Please assign a percentage value to each of the following categories as it relates to the portfolio of projects the company pursues. Total should be 100%	
2.1 Opening and start new plant/facility/product	
2.2 Expanding operation to new market	
2.3 Managing existing portfolios	
2.4 Internal organisation changes	
2.5 Others	

3. Portfolio Strategic Control: Premise Control

The following questions ask how your organisation apply premise control in portfolio of project. Please use the scale given below to indicate the extent you agree or disagree with the statements. Please put an "x" in selected box

1=Strongly Disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly Agree

Premise Control	1	2	3	4	5
We formulate premises about internal and external portfolio environment during portfolio defining process					
We conduct stakeholder analysis					
We continuously and systematically monitor portfolio environment to ensure assumptions are valid. It includes market situation, political situation, market position, budgetary constraints and etc.					
We select and prioritise portfolio components based on the defined assumptions					

4. Portfolio Strategic Control: Implementation Control

The following questions ask how your organisation apply implementation control in portfolio of project. Please use the scale given below to indicate the extent you agree or disagree with the statements. Please put an "x" in selected box

1=Strongly Disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly Agree

Implementation Control	1	2	3	4	5
We conduct milestone reviews as per portfolio management plan					
We measure portfolio performance and its components by balanced scorecard or critical success factors methods					
We identify critical components in portfolio, reviews those components by operational control instrument and use the results to decide about overall portfolio direction					
We optimise portfolio and balance portfolio components during portfolio aligning process.					

5. Portfolio Strategic Control: Strategic Surveillance

The following questions ask how your organisation apply strategic surveillance control in portfolio of project. Please use the scale given below to indicate the extent you agree or disagree with the statements. Please put an "x" in selected box

1=Strongly Disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly Agree

Strategic Surveillance Control	1	2	3	4	5
We develop high quality portfolio environmental information for early identification of strategic risks/issues and their potential impacts					
We anticipate trends and events that may affect portfolio objectives					
We develop a series of actions in order to manage risks and issues					

6. Portfolio Strategic Control: Special Alert Control					
The following questions ask how your organisation apply special alert control control in portfolio of project. Please use the scale given below to indicate the extent you agree or disagree with the statements. Please put an "x" in selected box					
1=Strongly Disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly Agree					
Special Alert Control	1	2	3	4	5
We monitor portfolio environment and identify high impact events with low probability that may provide crises in portfolio and accordingly in organisation					
We have a team in our portfolio who work with crises management team in organisation to develop required plans, actions, tools and techniques in order to respond to portfolio crises and evaluate the whole direction of portfolio					

7. Portfolio Interdependency					
The following questions ask about the interdependency among projects in portfolio. Please use the scale given below to indicate the extent you agree or disagree with the statements. Please put an "x" in selected box					
1=Strongly Disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly Agree					
Portfolio Interdependency	1	2	3	4	5
Projects share resources including employees and expertise					
Projects share an overall budget					
There is a high degree of alignment between our projects with respect to scope and content.					
Delays in individual projects inevitably impact other projects					
Some deliverables in one project are necessary to start one or more task in other project					

8. Portfolio Size	
The following questions ask about portfolio size based on portfolio annaul budget. Please put an "x" in selected box	
Portfolio annual budget is less than US$20m	
Portfolio annual budget is between US$21m and US$100m	
Portfolio annual budget is between US$101m and US$300m	
Portfolio annual budget is between US$301m and US$1000m	
Portfolio annual budget is over US$1000m	

9. Portfolio Dynamic

The following questions ask about portfolio dynamic and portfolio environmental turbulance. Please use the scale given below to indicate the extent you agree or disagree with the statements. Please put an "x" in selected box

1=Strongly Disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly Agree

Portfolio Dynamic	1	2	3	4	5
The stated portfolio objectives, targets and goals change regularly over portfolio lifecycle					
There are high level of unknowns at the start of the portfolio and high rate of new unknowns throughout the implementation phase					
To keep the portfolio alignment, priorities shift regularly over portfolio lifecycle					
Strategic changes of one portfolio have heavy potential impact on other portfolios in the organisation					
There are not sufficient skills and experts available within portfolio					

10. Portfolio Performance: Overall Business Success

The following questions ask about your overall business success. Please use the scale given below to indicate the extent you agree or disagree with the statements. Please put an "x" in selected box

1=Poor 2=Below Average 3=Average 4=Above Average 5=Outstanding

Overall Business Success	1	2	3	4	5
How do you evaluate the success of your organisation compared to your competitors regarding overall business success?					
How do you evaluate the success of your organisation compared to your competitors regarding the revenue growth?					
How do you evaluate the success of your organisation compared to your competitors regarding profitability?					
How do you evaluate the success of your organisation compared to your competitors regarding market share?					

11. Portfolio Performance: Aevarge Project Success

The following questions ask about your average project success. Please use the scale given below to indicate the extent you agree or disagree with the statements. Please put an "x" in selected box

1=Strongly Disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly Agree

Average Project Success	1	2	3	4	5
On average our projects achieve a high schedule adherence					
On average our projects achieve a high budget adherence.					
On average our projects achieve a high quality adherence.					
On average our projects are completed with a high degree of stakeholder satisfaction					

12. Portfolio Performance: Portfolio Balance

The following questions ask about portfolio balance. Please use the scale given below to indicate the extent you agree or disagree with the statements. Please put an "x" in selected box

1=Strongly Disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly Agree

Portfolio Balance	1	2	3	4	5
There is a good balance in our project portfolio of project risks					
There is a good balance in our project portfolio between new and old areas of application					
There is a good balance in our project portfolio to generate a constant cash-flow					
There is a good balance in our portfolio of projects in different implementation phases (early/late phases).					

13. Portfolio Performance: Portfolio Strategic Fit

The following questions ask about portfolio stratgeic fit in organisation. Please use the scale given below to indicate the extent you agree or disagree with the statements. Please put an "x" in selected box

1=Strongly Disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly Agree

Portfolio Stratgeic Fit	1	2	3	4	5
The project portfolio is consistently aligned with the future of the company					
The corporate strategy is being implemented ideally through our project portfolio					
Resource allocation to projects reflects our strategic objectives					

14. Organisation Governance Type

The following questions ask about your organisation governance type. Please use the scale given below to indicate the extent you agree or disagree with the statements. Please put an "x" in selected box

1=Strongly Disagree 2=Disagree 3=Neutral 4=Agree 5=Strongly Agree

Organisation Governance Type	1	2	3	4	5
Projects in our organisation do not share resources and do not have related objectives. (Multi-project organisation)					
Projects in our organisation do not share resources, but have related objectives. (Programme driven organisation)					
Projects in our organisation shared resources, but do not have related objectives necessarily. (Portfolio driven organisation)					
Projects in our organisation share resources and have related objectives. We combine and balance project, programme and portfolio management approaches. (Hybrid Organisation)					